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GENERAL

502 TID-3043(Suppl.2)

Technical Information Service, AEC.

UNCLASSIFIED BIBLIOGRAPHIES OF INTEREST TO THE ATOMIC ENERGY COMMISSION. Supplement 2. Hugh E. Voress, comp. Sept. 1955. 26p.

This compilation contains annotated references to bibliographies considered pertinent to the AEC program. Reports available at the Technical Information Service between July 20, 1954, and August 25, 1955, were reviewed. Selected published literature was also included. The bibliographies are arranged by subject and multiple listings are made for those which cover more than one subject. A table of contents lists the subjects covered and author and report number indexes are included. (See also TID-3043.) (auth)

ATOMIC BOMBS AND WARFARE

503 USNRDL-450

Naval Radiological Defense Lab., San Francisco.

PASSIVE DEFENSE PHILOSOPHY AND PRINCIPLES OF DAMAGE CONTROL IN ATOMIC ATTACK ON SHORE ESTABLISHMENTS. W. E. Strope. Sept. 1, 1954. 21p. Project NS 083-001.

Principles of passive defense and damage control in atomic attack are presented regarding naval shore establishments. The plan of action, based on a two-perimeter system and a cellular organization, operates over a range of possible atomic attacks. The plan should extend to the other services and civil defense; the organization should be trained for leadership as a cadre. Saving lives and property is the major goal of passive defense, requiring two systems: mutually supporting units to operate in damage control, and control of individual actions and protection of personnel under attack. (auth)

ATOMIC POWER

504 AECL-242

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CANADA'S NUCLEAR POWER DEVELOPMENT PROGRAMME. W. J. Bennett. Oct. 15, 1955. 13p.

In an address delivered by the President of Atomic Energy of Canada Limited, the Canadian nuclear power program is outlined. Comments on power reactor development, industrial participation, and international information exchange are included. (D.E.B.)

RESEARCH PROGRAMS

505 AECL-254

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE ATOMIC ENERGY PROGRAMME IN CANADA. W. J. Bennett. Oct. 27, 1955. 14p.

The text of an address to the National Industrial Conference Board by the President of Atomic Energy of Canada Limited is given. Raw materials, research, and power production are discussed. (D.E.B.)

506

UTILIZATION OF ATOMIC ENERGY FOR PEACEFUL PURPOSES. SESSIONS OF THE ACADEMY OF SCIENCE S.S.S.R. *Vestnik Akad. Nauk S.S.S.R.* 25, 34-46(1955) Aug. (In Russian)

Brief summarizing statements of papers presented at the conference are given. (R.V.J.)

BIOLOGY AND MEDICINE

507 UCLA-347

California. Univ., Los Angeles. Atomic Energy Project. SORPTION AND ORIENTATION PROPERTIES OF MACROMOLECULES. John W. Rowen and Hyla Cook. Oct. 11, 1955. 37p. Contract AT-04-1-Gen-12.

Two theoretical equations, one dealing with sorption and the other with orientation of macromolecules are evaluated and discussed. It is shown that the first equation, developed by Hill and Rowen dealing with sorption of macromolecules is useful in explaining certain binding phenomena. It is shown how this isothermal sorption relationship may be used in calculating the change in the number of sites which may accompany hysteresis. The equation is further discussed with special reference to proteins and nucleic acids. The second equation, developed by Peterlin, involves the extinction angle of birefringence as a function of gradient, viscosity and molecular weight. This relationship appears to be useful in characterizing the stiffness of certain flexible macromolecules but leads to low molecular weights of proteins. Nevertheless, it is shown that Peterlin's equation can be employed in the characterization of asymmetric molecules such as tobacco mosaic virus, desoxyribonucleic acid, and hyaluronic acid. (auth)

508 UCLA-351

California. Univ., Los Angeles. Atomic Energy Project. THE EFFECT OF CERTAIN ENVIRONMENTAL FACTORS ON CALCIUM, PHOSPHORUS, AND STRONTIUM UPTAKE BY BARLEY. W. L. Ehrler, E. M. Romney, and K. C. Hamner. Oct. 24, 1955. 22p. Contract AT-04-1-GEN-12.

509 UCLA-352

California. Univ., Los Angeles. Atomic Energy Project. DEMONSTRATION OF THE CENTRAL NERVOUS MEDIA-

TION OF ACUTE PULMONARY EDEMA PRODUCED BY INTRAVENOUSLY ADMINISTERED EPINEPHRINE. B. Cassen, W. Gutfreund, and M. Moody. Oct. 26, 1955. 10p. Contract AT-04-1-GEN-12.

Fifteen rats with severed spinal cords, kept alive on a respirator, were given massive doses of epinephrine that on controls produced consistently as intense acute pulmonary edema. None of these rats developed the usual acute edema, and in ten cases the lungs had normal weight. This result is interpreted as a proof of the central nervous mediation of the acute pulmonary edema produced by the administration of epinephrine. (auth)

510 AEC-tr-2275

A NEW MUTATION, FACET-NOTCHOID, OF *DROSOPHILA MELANOGASTER* AND THE SIGNIFICANCE OF THE NOTCH-EFFECT. Hans Bauer. Translated from *Z. indukt Abstamm.-u. Vererbhre.* 81, 374-90(1943). 31p.

511

PHOSPHORUS METABOLISM IN GROWING CULTURES OF *SACCHAROMYCES CEREVISIAE*. Bernard J. Katchman and William O. Fetty (Mound Lab., Miamisburg, Ohio). *J. Bacteriol.* 69, 607-15(1955) June.

RADIATION EFFECTS

512 AECU-3043

Michigan. Univ., Ann Arbor. Engineering Research Inst.

PROPOSED NEW METHOD OF WHOLESALING FRESH MEAT BASED ON PASTEURIZATION BY GAMMA RADIATION. L. E. Brownell, J. V. Nehemias, and J. J. Bulmer. Dec. 1954. 32p. Contract AT(11-1)-162.

A new method of wholesaling fresh meat is proposed for consideration by some of the larger packing houses and some of the larger retailers of fresh meat. This proposed new method consists of preparing packaged standard cuts of fresh meat, packaged fresh ground meat, packaged cut-up chicken, etc., in retail-size portions at the packing house rather than at the retail meat market, and of pasteurizing the packaged meat at the packing house by means of a relatively small dose of gamma radiation prior to shipping to the retailer. Radiation pasteurization extends the refrigerator shelf-life of fresh meat, so that this method should be feasible. Recent trends in retailing meats and the economics of meat processing suggest the desirability of handling meats in this way. (auth)

513 HW-35917

Hanford Atomic Products Operation, Richland, Wash. BIOLOGY RESEARCH-ANNUAL REPORT [FOR] 1954. Biology Section, Radiological Sciences Dept. Jan. 3, 1955. Changed from OFFICIAL USE ONLY Nov. 9, 1955. 188p. Contract W-31-109-Eng-52.

Research activities engaged in during the period are summarized. Progress is reported on studies of the effects of reactor effluent on aquatic and plant life; a radiobiological survey of the Columbia River; plant and animal absorption and metabolism of fission products, plutonium, and tritium; the chronic effects of ^{131}I and external radiations administered to sheep; the toxicity of radioactive particles; and the development of new or improved techniques applicable to radiobiological studies. (For preceding period see HW-30437.) (C.H.)

514 NM-006-012.04.81

Naval Medical Research Inst., Bethesda, Md.

THE USE OF SMALL LABROATORY ANIMALS IN MEDICAL RADIATION BIOLOGY. IV. CORRELATION OF PHYSICAL FACTORS WITH THE BIOLOGICAL EFFECT PRODUCED BY TOTAL-BODY IRRADIATION OF PIGS. Friedrich Ellinger, Jasper E. Morgan, Ellsworth B. Cook, and W. A. Sterling. June 27, 1955. 13p.

Base-line data on the lethal effect of total-body irradiation have been established on an inbred guinea pig strain to serve as fundamentals for subsequent studies of various problems in medical radiation biology. It has been demonstrated that guinea pigs can be used with an accuracy similar to that previously established for mice. The $\text{LD}_{50/14 \text{ days}}$ was found by probit analysis of the experimental data to be 337.4 r/air under the exposure conditions used. This study reveals a greater radioresistance of inbred guinea pigs in comparison to hybrid animals used by previous investigators. (auth)

515 NYO-3320

Columbia Univ., New York.

TERMINATION REPORT—PART I. FOOD IRRADIATION AND ASSOCIATED STUDIES. Sept. 15, 1954. 47p. Contract AT(30-1)-1186. (CU-3-54-AEC-1186-Chem.)

Results are summarized from the following studies: a two-year rat feeding experiment designed to test the possible unwholesomeness of partially irradiated diets; the effects of irradiated diet on rats; oxidative deterioration in irradiated milk; the effect of γ radiation on fats; and the γ -ray induced oxidation of ascorbic acid as studied and interpreted in terms of the oxidation of ferrous ion under similar conditions. (C.H.)

516 NYO-4642

Columbia Univ., New York. Radiological Research Lab. ANNUAL REPORT ON RESEARCH PROJECT. Apr. 1, 1955. 174p. Contract AT-30-1-GEN-70.

Radiological Physics. Calibration of tissue-equivalent ionization chambers for neutron dosimetry; construction of a special ionization chamber for the assessment of various radiations incident upon borated tissue; beta-ray dosimetry utilizing ionization chambers and internal gas multiplication; and radiation-induced leakage in the dielectric of ionization chambers having small volumes are discussed. Further experiments on the determination of W and a new method of determining the number of disintegrations per second for K-capture isotopes are reported. Results are reported from investigations of the tissue dose produced by radioisotopes when highly localized in small regions; depth dose determinations on thin sources of β -ray emitters of uniform surface density; and a method for simulating x-ray depth dose curves by light absorption and scattering in a water suspension of gum gamboge and dye. Radiobiology. Results are reported from studies on the radiosensitivity of the eyes of fetuses and the lens epithelium of laboratory animals; the postirradiation protection afforded rabbits by the injection of splenic plasma; and the effects of x and ultraviolet radiation, administered alone and consecutively, on bacteriophage. Summaries are included of work published during the period. (For preceding period see NYO-4582.) (C.H.)

517 UCLA-348

California. Univ., Los Angeles. Atomic Energy Project. NOTIONS ON SENSITIVITY OF CELLS TO RADIATION.

Ole A. Schjeide, James F. Mead, and Lawrence S. Myers, Jr. Oct. 15, 1955. 19p. Contract AT-04-1-GEN-12.

The cytoplasm of cells, since they contain, in large part, enzymes responsible for reduction of oxygen, are constantly exposed to small amounts of the radicals and oxidizing agents derived therefrom. Nuclei, on the other hand, are not concerned to the same degree with such reactions and consequently may not be as well protected, as are the cytoplasm, against such substances. Since ionizing radiation produces the same or similar destructive agents, it is proposed that initial damage by irradiation occurs at loci within the cell which are lacking in protective mechanisms, i.e., the nucleus. It is further proposed that certain cells owe their high radiation sensitivity to their relatively large proportion of, and consequent dependence on, the nucleus. (auth)

518 USNRDL-TR-58

Naval Radiological Defense Lab., San Francisco.
PHYSICO-CHEMICAL ALTERATIONS IN SPLEEN DEOXYRIBONUCLEOPROTEIN FOLLOWING IN VITRO X-IRRADIATION WITH 850 r. L. J. Cole and M. E. Ellis. Aug. 8, 1955. 30p. Project NM 006 015.

The deoxyribonucleoprotein (DNP) complex was isolated from spleens of immature mice, and characterized chemically as follows: it is soluble in distilled water, insoluble in 0.14M NaCl, and non-dialyzable; it has a N:P ratio of 4.5. The average protein: deoxyribonucleic acid (DNA) ratio is 1.7. The DNP complex contained approximately 5% ribonucleic acid. Following *in vitro* exposure of the DNP complex to x radiation of 850 r, there was faster release of free DNA by the action of added trypsin compared with non-irradiated DNP. DNP's ability to swell and dissolve in distilled water was inhibited after its exposure to 850 r. Pre-treatment of non-irradiated DNP with molar NaCl, followed by addition of water to 0.14M NaCl, resulted in increased susceptibility of DNP to trypsin action and in decreased swelling in distilled water. It is evident that low doses of x-ray *in vitro* elicit detectable physico-chemical changes in isolated spleen DNP. Results suggest that initial effect may involve labilization of protein-to-DNA bonds in the original complex. (auth)

519

PORTABLE PILOT PLANT FOR IRRADIATING POTATOES O. A. Kuhl, A. H. Sparrow, and B. Manowitz (Brookhaven National Lab., Upton, N. Y.). *Nucleonics* 13, No. 11, 128-9 (1955) Nov.

The design, operation, advantages, and cost estimates of a portable plant for irradiating potatoes with Co^{60} γ radiation are discussed. (B.J.H.)

520

SOME EFFECTS OF PERIODIC X-RADIATION. Louis E. Moon, Harry F. Harlow, George P. Bogumill (Univ. of Wisconsin, Madison). *Science* 122, 863-4(1955) Nov. 4.

Twenty-three monkeys were used in an investigation of progressive behavioral and physiological changes resulting from repeated mild doses of x radiation administered over a long period of time. Data are summarized. (C.H.)

521

REGENERATION OF X-RAYED SALAMANDER LIMBS PROVIDED WITH NORMAL EPIDERMIS. Florence C. Rose, Henry Quastler, and S. Meryl Rose (Univ. of Illinois, Urbana). *Science* 122, 1018-19(1955) Nov. 25.

522

HEMOLYSIN PRODUCTION IN IRRADIATED MICE GIVEN SPLEEN OR BONE-MARROW HOMOGENATE. Falconer Smith and H. Jeanette Ruth (National Cancer Inst., Bethesda, Md.). *Proc. Soc. Exptl. Biol. Med.* 90, 187-91 (1955) Oct.

Recovery of the production of hemolysin in irradiated mice receiving bone marrow or spleen cell homogenate occurred at the same rate as in litter-mate control mice exposed to 450 r of x rays. Recovery of antibody production in response to injected sheep erythrocytes is gradual and begins in the 4th week after exposure of mice to 450 r. Recovery of the hemolysin response is not complete even at 7 weeks after this dose of radiation since many of the mice had peak serum hemolysin titers that were below the limits of non-irradiated controls. The time required for the development of peak titer following a single immunizing injection was not lengthened by exposure to 450 r whole-body irradiation. (auth)

523

FATE OF ASCORBIC ACID IN EARLY RADIATION DAMAGE. Peter D. Klein, Dorothy T. Handa, and Robert W. Swick (Argonne National Lab., Lemont, Ill.). *Proc. Soc. Exptl. Biol. Med.* 90, 204-8(1955) Oct.

There were no gross changes in concentration or total content of ascorbic acid within 72 hours after 600 r of x-ray in rat liver, brain, pancreas, testis, muscle, kidney, or brown adipose tissue. Thymus, lymph nodes, and spleen showed a drop in ascorbic acid concentration within four hours, and the content of ascorbic acid continued to drop throughout the period studied. Intestinal mucosa showed a sharp increase in ascorbic acid concentration during the first 4 hours followed by a gradual decline. Stimulation of ascorbic acid synthesis by chlorthalidone administration does not modify the effects of irradiation, nor does the hydration of these tissues change in a fashion which might account for the observed phenomena. The observed changes in concentration could not be duplicated by the administration of aminopterin at a level of 10 mg/kg body weight. (auth)

524

RADIOBIOLOGY SYMPOSIUM-1954. PROCEEDINGS OF THE SYMPOSIUM HELD AT LIEGE, AUGUST-SEPTEMBER 1954. Z. M. Bacq and Peter Alexander, eds. New York, Academic Press, Inc., 1955. 362p. London, Butterworths Scientific Publications.

525

ALTERATIONS OF THE ULTRAVIOLET AND INFRARED SPECTRA OF ALBUMIN BY RADIATION. T. E. Pavlovskaya and A. G. Pasynskii. (Bakh biochemical Inst.). *Kolloid. Zhur.* 17, 305-14(1955) July-Aug. (In Russian)

Alterations of ultraviolet absorption spectra in the 240- to 340-m μ range of human serum albumin, serum albumin, gelatin, and blood serum of a horse with x and ultraviolet radiation of various doses and the infrared absorption spectra of human serum albumin and gelatin by x radiation were investigated. (R.V.J.)

526

VARIATIONS IN THE SENSITIVITY OF ESCHERICHIA COLI TO IONIZING RADIATIONS DURING THE GROWTH CYCLE. G. E. Stapleton (Oak Ridge National Lab., Tenn.). *J. Bacteriol.* 70, 357-62(1955) Oct.

527

ON THE EFFECT OF GAMMA RAYS ON THE BIOLOGICAL ACTIVITY OF THE RETINA. B. P. Kalashnikov. (Lenin State Research Inst.) *Doklady Akad. Nauk S.S.S.R.* 104, 64-7 (1955) Sept. 1. (In Russian)

Effects of Co^{60} gamma rays on rabbit retina were registered on a Siemens electrocardiograph. Electoretinograms are given. (R.V.J.)

528

RADIATION-INDUCED PYCNOSIS OF CHROMOSOMES AND ITS RELATION TO OXYGEN TENSION. C. P. Swanson and A. Helen Johnston (Johns Hopkins Univ., Baltimore and Oak Ridge National Lab., Tenn.). *Am. Naturalist* 88, 425-30 (1954) Nov.-Dec.

529

EFFECT OF X-RADIATION ON THE FLOW OF PERFUSION FLUID THROUGH THE ISOLATED RABBIT'S EAR. Herbert B. Gerstner, Phillips M. Brooks, and Sidney A. Smith (USAF School of Aviation Medicine, Randolph Field, Tex.). *Am. J. Physiol.* 182, 459-61 (1955) Sept.

Flow rate, protein washout, and weight gain were measured in 100 isolated rabbit's ears perfused with Tyrode's solution at 24°C under a pressure of 24 to 25 mm Hg. Fifty of the ears received x radiation from 1 to 8 kr; the remaining 50 served as controls. X radiation caused an immediate but transitory reduction of flow rate; the effect became more striking the higher the dose. The irradiated ears showed a marked protein washout that could be demonstrated by addition of sulfosalicylic acid to the perfusate. The weight gain caused by the perfusion with colloid free solution showed no significant difference between controls and irradiated ears. (auth)

530

EFFECTS OF WHOLE BODY X-IRRADIATION ON 17-HYDROXYCORTICOSTEROID LEVELS, LEUCOCYTES AND VOLUME OF PACKED RED CELLS IN THE RHESUS MONKEY. A. B. French, C. J. Migeon, L. T. Samuels, and J. Z. Bowers (Univ. of Utah Coll. of Medicine, Salt Lake City). *Am. J. Physiol.* 182, 469-76 (1955) Sept.

Plasma 17-hydroxycorticosteroid levels, total white counts, direct eosinophil counts, differential white cell counts, and volume of packed red cells were followed in 1 cynomolgus and 23 rhesus monkeys after total-body x irradiation in doses of 50 to 800 r. Data are summarized. (auth)

531

EFFECT OF X-IRRADIATION ON GLUCOSE ABSORPTION. H. M. Dickson (Brown Univ., Providence, R. I.). *Am. J. Physiol.* 182, 477-8 (1955) Sept.

X irradiation reduced the rate of glucose absorption from the intestine in mice. This effect could not be attributed to retarded gastric emptying or to a diminution of intestinal hexokinase. (auth)

532

CELLULAR AND TISSUE RADIOLESIONS; THEIR CONSEQUENCES AND THEIR DISTRIBUTION. J. Maisin, H. Maisin, A. Dunjic, and P. Madaque. *J. belge radiol.* 38, 394-429 (1955). (In French)

An intestinal syndrome appearing within 3 days after irradiation, and a medullar syndrome occurring between the 9th and 15th day after irradiation were both found to contribute to the death of rats exposed to 700-r x radiation. Data on the protective effects of small lead screens and of

mercaptoethylamine injections against radiation injuries in rats are summarized. (C.H.)

533

EFFECTS OF RADIATION ON GLYCOGEN PROCESSES IN ANIMALS EXPOSED TO X RAYS. R. Ya. Keilina. *Biokhimiya* 20, 420-4 (1955) July-Aug. (In Russian)

Investigation of glycogen reactions in animals exposed to lethal and sublethal doses of x rays were made with rats weighing 150 to 200 g. Various tables of results obtained before and after exposure to 500 r and after lethal doses of x rays are presented. Results proved that decay of liver glycogen in rats not exposed to x rays was basically phosphoryl. In rats exposed to 500 r radiation, after two days interval, phosphoryl glycogen was depressed, and glycogen decay took place as result of hydrolysis while hexokinase activity was not disturbed. (R.V.J.)

534

EFFECTS OF ULTRAVIOLET AND X RADIATION ON ALBUMIN SOLUTIONS. M. S. Volkova and A. G. Pasynskii. *Biokhimiya* 20, 470-8 (1955) July-Aug. (In Russian)

Detailed study was made of denaturing variations of albumin solutions affected by ultraviolet and x radiation, and their comparison with the general theory of denaturing phenomenon was investigated for human serum albumin and horse serum globin (for viscosity, solution, turbidity amino nitrogen, etc.) in aqueous and buffer solutions with various doses of ultraviolet and x radiations. The quantum yield of the serum albumin denaturing (mean values for intervals 250 to 335 mμ in 7×10^{-4} aqueous solution and buffer solution of pH 5.91- to 5.3×10^{-4}) and 37% dose of denaturing serum albumin by x rays (1,000,000 r) were determined for the first time. Experiments proved that quantum yield volume is comparatively independent from the dose and intensity of radiation on the concentration of the albumin. (R.V.J.)

Refer also to abstract 656.

RADIATION HAZARDS AND PROTECTION

535 AECU-3100

Atomic Energy Commission, Washington, D. C. RADIATION HAZARDS IN FIREFIGHTING. Safety and Fire Protection Technical Bulletin No. 4. [1955]. 39p.

Safety and Fire Protection Technical Bulletins 1-3 are not available.

Firefighting techniques are discussed for use when radioactivity is a factor. It is pointed out that radiation should be neither feared nor ignored but should be regarded as another hazard to be taken in stride as a result of education and understanding. (C.H.)

536 NP-5815

Chicago. Univ. Air Force Radiation Lab. QUARTERLY PROGRESS REPORT NO. 17. Oct. 15, 1955. 132p. Contracts AF33(038)-27353 and AF41(657)-25.

Progress is reported on studies of the toxic and radiosensitivity effects of six substituted amines and two isothiourea derivatives in mice; the effects of some anti-metabolites, cellular preparations, testosterone propionate and various estrogenic preparations on the radiosensitivity of mice and rats; the effects of various fractional doses of x radiation and various exposure schedules on survival time, weight loss, and 5-nucleotidase activity of the spleens

and thymus glands of rats; the effects of ionizing radiations on the biochemistry of mammalian tissues; the effects of single and fractionated exposures to whole-body x radiation on the metabolic rate in rats and mice; the effect of 800 r whole-body x irradiation on the free amino acid content of rat plasma; the survival time, weight loss, and mortality of rats exposed to simulated altitudes of 25,000 and 30,000 ft at an environmental temperature of 65°, 80°, or 100°F during the administration of lethal and sublethal doses of whole-body x irradiation. (For preceding period see NP-5730.) (C.H.)

537 USNRDL-TR-59

Naval Radiological Defense Lab., San Francisco.

GROWTH AND CONTINUED FUNCTION OF RAT MARROW CELLS IN X-IRRADIATED MICE. P. C. Nowell, L. J. Cole, J. G. Habermeyer, and P. L. Roan. Sept. 2, 1955. 13p. Project NM 006 015.

Blood and bone marrow smears from rats and mice were treated for histochemical demonstration of alkaline phosphatase activity. In the rat, mature neutrophilic leukocytes showed marked activity of the enzyme, while immature myeloid cells, megakaryocytes, and nucleated red cells showed less activity. In mouse smears, no phosphatase was observed in corresponding cells. After intravenous injection of rat marrow cell suspension into x-irradiated mice (810 r), alkaline phosphatase-positive cells were found in blood and bone marrow of the mouse within 2 hr. At 7 days, the percentage of phosphatase-positive cells markedly increased in irradiated mice; in the second, third, and fourth weeks after irradiation, the cells composed almost the entire mouse marrow population and were morphologically indistinguishable from rat marrow cells. There was no evidence of a return of phosphatase-negative (i.e., mouse) marrow cells during the 28-day period studied. Findings indicate that injected rat marrow cells are able to survive, divide, and repopulate the marrow cavity of irradiated mice. The cells function hematopoietically and permit survival of the mice following otherwise lethal doses of radiation. (auth)

538

ACTH IN RADIOTHERAPY. A CLINICAL TRIAL. K. Sicher (Coventry and Warwickshire Hosp., Coventry, England). *Brit. J. Radiol.* 28, 620-22 (1955) Nov.

A brief survey is given of literature on the effects of ACTH on bone marrow and on radiation sickness. A personal experience of application of this drug in radiotherapy is described, and the results of a clinical trial are discussed. (auth)

539

MODIFICATION OF X-RAY SENSITIVITY OF BEAN ROOTS BY HYDROGEN GAS. Michael Ebert and Alma Howard (Hammersmith Hospital, London). *Nature* 176, 828-9 (1955) Oct. 29.

540

THE EFFECT OF CYSTEAMINE, CYSTAMINE AND HYPOXIA ON MORTALITY AND BONE MARROW CHROMOSOME ABERRATIONS IN MICE AFTER TOTAL BODY ROENTGEN IRRADIATION. Finn Devik and Francis Lothe. *Acta Radiol.* 44, 243-8 (1955) Sept. (In English)

A total of 154 mice were subjected to 1,100 r and 110 mice to 200 r total-body irradiation following the administration of cysteamine or cystamine in order to gauge the protective properties of these substances against irradi-

ation damage. With the former dose, death of the mice was the indicator of damage while, with the latter dose, chromosome aberrations in the bone marrow were evaluated quantitatively. In both series, the chemical compounds showed a protective effect which was increased when hypoxia was induced prior to and continued during the exposure. (auth)

541

MODIFICATION OF THE RADIOSENSITIVITY OF RAT BY DEEP HYPOTHERMY. S. Hajdukovic. *Acta Radiol.* 44, 249-56 (1955) Sept. (In French)

It was found that 50% of rats, irradiated in the state of deep hypothermy (rectal temperature of 14 to 15°C) with lethal doses of 800 and 900 r, survived more than 30 days whereas all controls died within 17 days. The same degree of protection is obtained if the cooling is made in the presence of oxygen or under an air pressure of 1.25 atmosphere. It is likely that the influence of hypothermy on the mortality of roentgen-irradiated mammals is related to the general level of metabolic processes and not only due to anoxia. (auth)

542

URANIUM MINING OPERATIONS ON THE COLORADO PLATEAU. J. D. Torrey and P. W. Jacoe (Colorado State Dept. of Public Health, Denver). *Arch. Ind. Health* 12, 375-7 (1955) Oct.

The studies to date indicate that the primary hazard involved in mining uranium arises from the alpha emitters of radon, RaA, and RaC'. It is further indicated that the most economical way to control the hazard is by well-planned ventilation. This calls for an engineering study of the actual, as well as the anticipated, mining operations, to choose the type of ventilation required. Inclines, shafts, and stope mines will require different ventilation systems, dependent upon the size, distance, and other factors, and these factors must be considered before the choice of a method can be made. Furthermore each mine offers a unique problem in itself and must be considered from this standpoint. (auth)

543

THE TOTAL DOSE RECEIVED BY A WORKER EXPOSED TO RADIATIONS. UTILIZATION OF FILM BADGES. J. Govaerts. *J. belge radiol.* 38, No. 3, 387-93 (1955). (In French)

Since 1951 a service of film badges for workers exposed to roentgen and nuclear rays has been organized by the University of Liege in collaboration with the Union Minière du Haut Katanga. About 1,500 badges have been examined during 88 weeks. (auth)

Refer also to abstract 726.

RADIOTHERAPY

544 ORINS-10

Oak Ridge Inst. of Nuclear Studies, Inc.

TELETHERAPY DESIGN PROBLEMS. IV. ISODOSE CHARTS FOR THE Co⁶⁰ HECTOCURIE TELETHERAPY MACHINE. Marshall Brucer. Mar. 15, 1955. 157p. Contract AT(40-1)-GEN-33.

545 UR-397

Rochester, N. Y. Univ. Atomic Energy Project.

COMPARATIVE IN VIVO AND IN VITRO TISSUE FIXATION

STUDIES OF I^{131} LABELED ANTI-BODIES PREPARED IN RABBITS AGAINST RAT KIDNEY, LYMPH NODE, AND TUMOR TISSUE. William F. Bale, Irving L. Spar, Ruth L. Goodland, and Dolores E. Wolfe. July 15, 1955. 117p. Contract W-7405-eng-49.

The use of tissue specific antibodies as carriers of radioactivity for therapeutic purposes was investigated. *In vitro* methods developed to measure binding of I^{131} -labeled anti-rat organ antibodies (from the sera of rabbits immunized against rat organs) by various rat tissues are described. Comparison is made of the *in vitro* specificities of antibody preparations as measured by this method and *in vivo* distribution of I^{131} following intravenous injection of labeled antibodies into rats. Results from studies of the degree of antibody purification achieved by various absorption-elution purification techniques are included. (auth)

Refer also to abstract 956.

TOXICOLOGY STUDIES

546 AECD-3695

Mound Lab., Miamisburg, Ohio.

REPORT FOR BIOLOGICAL RESEARCH [FOR] NOVEMBER 27, 1950 TO MARCH 19, 1951. Apr. 23, 1951. Decl. with deletions Oct. 11, 1955. 60p. Contract AT-33-1-GEN-53.

Data are summarized from studies on the toxic and pathological effects of Po on laboratory animals. (C.H.)

547 MLSR-30

Chemical Corps Medical Labs., Army Chemical Center, Md.

THE TOXICOLOGY OF HYDRAZINE—A REVIEW. Stephen Krop. Aug. 1953. 9p.

548 UR-411

Rochester, N. Y. Univ. Atomic Energy Project.

THE HISTOPATHOLOGY OF MICE EXPOSED TO RADON. James K. Scott. July 26, 1955. 13p. Contract W-7401-eng-49.

Mice were exposed to an atmosphere containing radon, relatively free of decay products, for 18 hr at a concentration of 2.4×10^{-4} c/l giving a total dose of 4.3 millicurie hours per liter. This dose was chosen because it was known from previous experiments that a definite radiation effect could be obtained and that the animals would survive for the duration of the experiment. Animals were sacrificed at intervals beginning 12 hr following exposure and terminating 7 mo later. The cellular destruction, the rate of repair and regeneration, and widespread distribution of lesions in different organs were the same as those observed in total-body x irradiation. There was proliferation of bronchial epithelial cells which contained large hyperchromatic bizarre nuclei in animals examined at 5 and 7 mo after exposure. The kidneys of animals sacrificed after 5 mo showed both atrophy and proliferation of tubular epithelium and many of the nuclei were large and hyperchromatic, the glomeruli were reduced in size, and there was an increase in thickness of the media of small arteries. The renal lesions are similar to those occurring after intravenous injection of Po or Rn in equilibrium with its decay products. (auth)

549 AEC-tr-2230

INJURIES TO HEALTH FROM CASTING RESINS (PLASTICS). (Über Gesundheitschaden Durch Glessharze). A. Pletscher, R. Schuppli, and R. Reipert. Translated by Marcel Weinreich from *Z. Unfallmed. Zuer.* 47, 163-76 (1954).

Skin lesions are described which were found among factory employees who work with cold-hardening ethoxilin plastics. The noxious effects of triethiolene tetramine, dimethylamino propylamine, and ethoxilin plastics are discussed. The degree of severity in skin pathology did not depend on the duration of contact with the plastics. The skin changes appeared generally a few weeks or months after start of exposure to plastics and hardeners. Symptom were usually slight, and no interruption of work occurred. (C.H.)

550 AEC-tr-2290

BIOCHEMICAL ACTION OF SOME BERYLLIUM SALTS IN THE ANIMAL ORGANISM. Stefano Marradi Fabroni. Translated from *Med. lavoro* 26, 376-8(1935). 14p.

551 AEC-tr-2291

PULMONARY PATHOLOGY OF BERYLLIUM POWDERS. Stefano Marradi Fabroni. Translated from *Med. lavoro* 26, 297-303(1935). 4p.

552

BIOLOGICAL STUDIES ON STABLE AND RADIOACTIVE RARE EARTH COMPOUNDS. II. THE EFFECT OF LANTHANUM ON MICE BEARING EHRILICH ASCITES TUMOR. Ruth Lewin, Kurt G. Stern, Daniel M. Ekstein, Leonard Woldowsky, and Daniel Laszlo (Montefiore Hospital, New York and Polytechnic Inst. of Brooklyn). *J. Natl. Cancer Inst.* 14, 45-56(1953) Aug.

553

ACUTE TOXICITY OF RADON. Donald A. Morken (Univ. of Rochester, N. Y.). *Arch. Ind. Health* 12, 435-8(1955) Oct.

Mice exposed to radon free of decay products exhibit all the gross toxic symptoms reported in the literature from experiments in which decay products were present. The 30-day LD_{50} of CAF_1 mice exposed to pure radon has been found to be lower than any value reported previously and lies between 5.7 and 8.8 mc-hr per liter. Anemia was less marked than after an x-ray exposure of comparable lethality. Measurements of air activity indicate that atmospheres of radon essentially free of the decay products of radon may be produced. Preliminary data are included on the shortening of life span produced by exposure to radon in the range of 1.1 to 8.8 mc/hr per liter. (auth)

TRACER APPLICATIONS

554 UCLA-349

California. Univ., Los Angeles. Atomic Energy Project. THE INFLUENCE OF SOIL ORGANIC MATTER ON THE UPTAKE OF Sr^{90} BY BARLEY AND TOMATO PLANTS. Hideo Nishita, Bruce W. Kowalewsky, Kermit H. Larson. Oct. 17, 1955. 42p. Contract AT-04-1-GEN-12.

Studies of the influence of soil organic matter on plant uptake of Sr^{90} in modified Neubauer and pot experiments showed that the Sr^{90} uptake by barley and tomato plants was influenced by incubation time before cropping, organic matter concentration, and the kind of organic matter. The

relative effect of a given organic material on Sr^{90} uptake depended on soil type. The uptake of Sr^{90} decreased as organic matter concentration was increased; this treatment, in turn, increased the soil microbial population. The reduction of Sr^{90} uptake with increasing organic matter concentration appeared to be a result of several factors: microbial immobilization of Sr^{90} , increased Na and K uptake causing a suppression of Sr^{90} uptake, and the detrimental effect of an organic matter decomposition product, or products, on absorption. The uptake of Ca closely paralleled the uptake of both radioactive and stable native Sr. The root Sr/Ca atom ratios increased with increasing additions of organic matter to soils. The top Sr/root Sr ratios were decreased by the addition of organic matter to the soil, indicating that Sr translocation was affected. Magnesium and Mn uptake was influenced by organic matter, but they did not appear to be closely related to Sr uptake. A study of the plant availability of Sr^{90} from non-radioactive soil treated with radioactive plant material and radioactive soil treated with non-radioactive plant material showed little or no difference between the two modes of contamination. (auth)

555 UCLA-350

California. Univ., Los Angeles. Atomic Energy Project. PLANT UPTAKE OF Fe^{59} -TAGGED IRON FROM A SLOWLY SOLUBLE SOURCE. W. A. Rhoads, E. M. Romney, and A. Wallace. Oct. 19, 1955. 19p. Contract AT-04-1-GEN-12.

Crops of barley, soybean, and lemon plants obtained less than 0.025% of the total amount of Fe^{59} -tagged iron applied to Sassafras, Hanford, and Sorrento soils in the form of a fused, glassy material that might be used to simulate primary fall-out materials. (auth)

556 UR-414

Rochester, N. Y. Univ. Atomic Energy Project. THE BINDING OF POLONIUM BY RED CELLS AND PLASMA PROTEINS. Robert G. Thomas and J. N. Stannard. Oct. 19, 1955. 18p. Contract W-7401-eng-49.

An average of 97 and 83% of the red cell and plasma Po, respectively, appears to be bound to proteinaceous material when PoCl_3 is given either intravenously or orally to rats. Erythrocyte stroma preparations show a polonium concentration equal to that of hemoglobin. Globin binds all of the hemoglobin polonium and plasma proteins appear to share the metal according to their respective concentrations. Both red cell and plasma lipids give no evidence of radioactivity. It is proposed that an equilibrium exists between red cells, plasma, and tissues with respect to Po metabolism and that the relationship between each compartment is a direct function of the effective half life in each. Data on the uptake of Po by red cells soon after intravenous injection to the rat and rabbit are interpreted in terms of this proposal. (auth)

557

INCORPORATION OF C^{14} -LABELED AMINO ACIDS BY TRICHINELLA SPIRALIS LARVAE. Richard D. Stoner and Lawrence V. Hanks (Brookhaven National Lab., Upton, N. Y.). *Exptl. Parasitol.* 4, 435-44(1955) Sept.

558

FAILURE OF Y^{90} TO ESCAPE FROM SKELETALLY-FIXED Sr^{90} . J. S. Arnold, B. J. Stover, and M. A. Van Dilla (Univ. of Utah Coll. of Medicine, Salt Lake City). *Proc. Soc. Exptl. Biol. Med.* 90, 260-3(1955) Oct.

The data presented demonstrate that Y^{90} produced in

vivo from long term skeletal deposits of Sr^{90} in young dogs does not escape from the local areas of bone in which it is produced. This is in agreement with previous experimental evidence. The implications of this finding are as follows: First, the combined energy of the Sr^{90} and Y^{90} beta rays irradiates the skeleton. Hence, dosimetric data determined in vitro can be directly applied to in vivo conditions. Second, the Sr^{90} deposited in the growing skeleton is probably intracrystalline. This is in agreement with the x-ray diffraction findings of McDonald. Work is in progress to see whether this effect occurs in older dogs where there is less bone growth and less crystal formation. (auth)

Refer also to abstract 623.

WASTE DISPOSAL

Refer also to abstract 755.

CHEMISTRY

559 AD-39839

American Electro Metal Corp., Yonkers, N. Y. INVESTIGATION OF THE EFFECT OF RAW MATERIAL PRODUCTION VARIABLES ON THE PHYSICAL AND CHEMICAL PROPERTIES OF CARBIDES, NITRIDES AND BORIDES. Progress Report No. 14 for the Period July 1 to August 31, 1954. H. Blumenthal. 14p. Project No. 51-6154-285 (17). Contract AF33(616)-89.

The investigation was continued with the study of the influence of free C on bonded and unbonded TiC. Mixtures of TiC powders with 20% Ni and 0.5 to 2.0% graphite were hot-pressed and vacuum-sintered for 2 hr at 1350°C. The densities and transverse rupture strengths are tabulated. Sintering resulted in a density of 84 and 87% when 2.0% graphite was added. Free C did not affect densification and transverse rupture strengths to a high degree. The influence of Cr_3C_2 and TaC was investigated. Samples of TiC were mixed with 20% Ni and either 3% Cr_3C_2 or 3% TaC and processed. Vacuum-sintering of the mixtures did not result in further densification. TiC powders were mixed with 20% Ni in a WC mill with CCl_4 as ball milling medium for 144 hr. Pressing procedures included dried and hot-pressed, dried and cold-pressed, and cold-pressed in the wet condition. Most wet-pressed bars cracked during sintering. Good densification was obtained with both hot- and cold-pressing techniques. Only Ti alloy powder did not densify satisfactorily when cold-pressed. The variations in transverse rupture strength of the different materials was considered characteristic for the particular powders. (ASTIA abst.)

560 AECD-3664

Aerojet General Corp., Azusa, Calif. A STUDY OF THE REACTION OF METALS AND WATER. Interim Report. H. M. Higgins. Apr. 15, 1955. Decl. with deletions Aug. 11, 1955. 62p. Contract AT(04-3)-44.

The molten metals Zr, Zircaloy-2, U, U-Mo alloy, Al, Al-Li alloy, and Mg were introduced into H_2O in order to determine whether or not violent reactions would result. As long as the molten metals remained as comparatively large globules, the reaction ceased after some surface

scale formed. When a means of dispersing the molten metals in H_2O was provided, all those tested except Al underwent a violent reaction (U and the alloy of U and Mo were not tested using the dispersal method). Pressure-time records and other data were obtained which indicate the degree of damage that might be expected from violent reactions of these metals and water. Corrosion-rate tests were made on Zr, U-Mo alloy, and stainless steel in H_2O at atmospheric pressure. Corrosion-rate tests were made on Zr and U in water vapor at 600 psi. (auth)

561 AECU-3058

Oregon. Univ., Eugene.

STUDIES ON THE ANODIC POLARIZATION OF ZIRCONIUM. I. THE FORMATION FIELD FROM BOTH HIGH-POTENTIAL AND LOW-POTENTIAL MEASUREMENTS. II. POROSITY OF VERY THIN ANODIC OXIDE FILMS. III. THICKNESSES OF VERY THIN AIR-FORMED OXIDE FILMS. IV. A LOW-POTENTIAL CURRENT-VOLTAGE REGULATOR. George B. Adams, Jr., Mario Maraghini, Tien-Shuey Lee, and Pierre Van Rysselberghe. July 1955. 35p. Contract AT(45-1)-535.

A comparison of the formation fields obtained in the low and high potential ranges indicates that only one potential-determining reaction occurs, namely the oxidation of Zr to ZrO_2 . The porosities of the ZrO_2 films formed anodically at 1.6 and 25 volts in NO_3^- and SO_4^{2-} solutions were determined. The thicknesses of oxide films formed on freshly abraded Zr by exposure to air at room temperature were estimated from anodic and external current measurements. An electronic device to maintain a constant current over a small range of potential has been designed and constructed. (See also AECU-2918.) (C.W.H.)

562 AECU-3084

Los Alamos Scientific Lab., N. Mex.

THE SPECTROPHOTOMETRIC DETERMINATION OF DISSOCIATION CONSTANTS OF DIBASIC ACIDS. METHODS USING A MINIMUM AMOUNT OF DATA. Burton J. Thamer. [1954]. 12p. Contract [W-7405-eng-36].

Two spectrophotometric methods are given for determining dissociation constants of dibasic acids. Each method is applicable for any degree of overlapping of the dissociation constants. Neither method requires a direct measurement of the extinction coefficient of any of the individual species that are in equilibrium with each other. A minimum amount of data is required in either method. (auth)

563 BM-3289

Bureau of Mines. Explosives and Physical Sciences Div., Pittsburgh.

GENERAL THEORY OF CHEMICAL REACTION RATES. Interim Technical Report. John M. Richardson. Mar. 5, 1953. 18p. Contract AF 18 (600)-156. (AD-13795)

The main features of a general theory of chemical rate processes, based on a special application of a theory of irreversible processes, are presented. The preliminary mathematical analyses of the problem are described. (C.W.H.)

564 CCC-1024-TR-147

Michigan. Univ., Ann Arbor.

DETERMINATION OF THE LOW-TEMPERATURE HEAT CAPACITY OF ANHYDROUS AND VITREOUS SODIUM TETRABORATE. E. F. Westrum, Jr. and G. Grenier. Oct. 26, 1955. 22p.

The heat capacities of anhydrous crystalline and vitreous sodium tetraborate ($Na_2B_4O_7$) were determined from about 6 to 350°K by adiabatic calorimetry. Values of the heat capacity and the derived thermodynamic functions have been computed and tabulated. Molal values at 298.16°K of the heat capacity at constant pressure, entropy, enthalpy increment ($H_T - H_0^0$), and free-energy function are: 44.64 cal/°C, 45.30 cal/°C, 7262 cal, and -20.94 cal/°C, respectively, for the crystalline modification. For the vitreous modification, the molal values at 298.16°K of the heat capacity at constant pressure, the entropy increment ($S_T^0 - S_0^0$), and enthalpy increment ($H_T^0 - H_0^0$), are: 44.42 cal/°C, 44.39 cal/°C, and 7127 cal, respectively. (auth)

565 CCC-1024-TR-148

Michigan. Univ., Ann Arbor.

DETERMINATION OF THE LOW-TEMPERATURE HEAT CAPACITY OF ANHYDROUS SODIUM METABORATE. E. F. Westrum, Jr. and G. Grenier. Oct. 28, 1955. 21p.

Adiabatic measurements of heat capacity have been made on sodium metaborate from about 6 to 350°K. No evidence of anomalous behavior was detected by these measurements. Values of the derived thermodynamic functions are given at rounded temperatures together with the smoothed heat-capacity data. Molal values at 298.16°K of the heat capacity at constant pressure, entropy, enthalpy increment, and free-energy function are: 15.76 cal/°C, 17.57 cal/°C, 2780 cal, and -8.25 cal/°C, respectively. (auth)

566 DOW-76

Dow Chemical Co. Western Div., Pittsburg, Calif.

PROGRESS REPORT [FOR] APRIL 1952. Research Dept. R. H. Bales. May 12, 1952. Decl. Sept. 29, 1955. 71p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in derosene diluent for the recovery of uranium from industrial phosphoric acid is described. Studies of the chemistry and mechanics of the extraction process are reported. (auth)

567 IDO-16141

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A PROPOSAL FOR ALUMINUM-WATER REACTION EXPERIMENTS IN THE MTR. O. J. Elgert. Dec. 3, 1953. Decl. Sept. 12, 1955. 12p. Contract AT(10-1)-205.

A literature survey of explosive Al- H_2O reactions is presented and some general conclusions regarding the possibility of such a reaction under reactor conditions are made. It is proposed to conduct Al- H_2O reaction experiments in the $1\frac{5}{16}$ " I.D. hydraulic rabbit tube of the MTR in which the reactants are contained in small pressure bombs, and in a fuel plate as proposed earlier for the Film Boiling Experiment. (auth)

568 ISC-247

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT IN ENGINEERING FOR JANUARY, FEBRUARY AND MARCH 1952. June 20, 1952. Decl. Sept. 8, 1955. 21p. Contract W-7405-eng-82.

Progress is reported on the production of Th from monazites, solvent extraction of Hf from Zr with TBP, recovery of silica gel from adsorption runs, production of UO_3 slurries, and development of extraction and drying apparatus. (For preceding period see ISC-220.) (C.W.H.)

569 ISC-530

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JULY, AUGUST AND SEPTEMBER 1954.

Dec. 20, 1954. Decl. Sept. 8, 1955. 38p. Contract W-7405-eng-82.

Progress is reported on the following investigations: allotropic modifications of Ce, La, Pr, and Nd; phase studies of La-Nd alloys; determination of transport numbers of TiCl and PbBr_2 ; thermal decomposition of GaI_2 ; metal-metal extraction of U with Ag, Ce, and La; ionization constants of β -diketones in H_2O ; exchange of chloride between Cl^- and PtCl_4^{2-} ; extraction of TiCl_3 ; photonuclear processes of As^{75} , Fe^{54} , and Ir^{192} ; and hydrogen bonding. (For preceding periods see ISC-505.) (C.W.H.)

570 ISC-574

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR OCTOBER, NOVEMBER, AND DECEMBER 1954. Apr. 6, 1955. Decl. Sept. 23, 1955. 32p.

Contract W-7405-eng-82.

An evaluation of the EDTA elution method for the separation of various rare earths is reported. New data on Tm and Dy are presented. The transport numbers of fused TiCl and several metal-metal salt solubilities were determined. Metal-metal extraction studies were carried out on several materials. Analytical methods for the determination of Mo, Ru, Ti, and Zr, metal chelate formation and reactions, and β -diketone structures are briefly outlined. Spectral studies on Te^{120} , Os^{191} , Ir^{194} , and other photonuclear processes are presented. A procedure is outlined for the separation of Ni and Zn from Ga. The rates of exchange of Mn between its various oxidation states were studied. The studies on H bonding and metal complex bonding were continued. (For preceding period see ISC-530.) (C.W.H.)

571 ISC-643

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR APRIL, MAY, JUNE 1955. Oct. 24, 1955. 24p. Contract W-7405-eng-82.

Progress is reported on the following studies: structures of rare earths and rare-earth compounds; chemistry of Ga in aqueous base; volumetric determination of Hg; determination of S in organic compounds; photonuclear reactions of Fe^{54} , Fe^{57} , Br^{80} , and As^{75} ; and solubility of AgIO_3 in salt solutions. (For preceding period see ISC-606.) (C.W.H.)

572 JPL-PR-20-219

California Inst. of Tech., Pasadena. Jet Propulsion Lab. HEAT OF FORMATION AND ENTROPY OF TITANIUM TETRACHLORIDE. Progress Report. Walter F. Krieve, Alfred J. Darnell, Gerald W. Elverum, Jr., Milton Farber, and David M. Mason. Jan. 4, 1954. 16p. Contract DA-04-495-Ord-18. (AD-62227)

Values of the heat of formation of TiCl_4 existing at present are based on a single experimental measurement of the heat of the reaction of liquid TiCl_4 and H_2O made in a constant-volume calorimeter by Thomsen in 1870. The values of the heat of formation which are derived from this measurement are dependent on values of the heat of formation of all the compounds involved in this hydrolysis reaction. There is an uncertainty as to the identity and state of end products of the hydrolysis reaction which may lead to error in the value of the heat of formation. Direct

chlorination of titanium metal appears to be one method for determining the heat of formation of TiCl_4 that eliminates some of these uncertainties. A nonflow type of constant-volume, adiabatic calorimeter bomb constructed of nickel was used, and the spontaneity of the reaction between chlorine gas and titanium metal in the form of a sponge was utilized to measure the heat of formation of TiCl_4 . The solubility of Cl_2 in liquid TiCl_4 was determined in order to provide data for making small volumetric corrections for the amount of Cl_2 dissolved in the liquid phase and small thermal corrections for the heat of solution of Cl_2 in TiCl_4 . The heat of formation of liquid TiCl_4 was found by this method to be 190.0 ± 0.4 kcal/gm mol at 298°K and at 1 atmosphere, and the corresponding heat of formation of gaseous TiCl_4 was found to be 180.4 ± 0.4 kcal/gm mol. To obtain an independent measurement of the heat of formation and to determine the entropy of TiCl_4 , an equilibrium flow method was used to study in the temperature range 600 to 1400°K the reaction TiO_2 (solid rutile) + 4HCl (gas) \rightleftharpoons TiCl_4 (gas) + $2\text{H}_2\text{O}$ (gas). The experimental value of the enthalpy of reaction in this temperature range is 12.9 kcal. That TiO_2 and HCl react to give these products and no oxychlorides of titanium was experimentally checked in several ways. The value of the heat of formation of gaseous TiCl_4 at 298°K and at 1 atmosphere determined by this method is 182.9 ± 0.5 kcal/gm mol based on a value for the heat of formation of TiO_2 of 225.5 kcal/gm mol. The corresponding heat of formation of liquid TiCl_4 is 192.5 ± 0.5 kcal/gm mol. These values for the heat of formation of gaseous or liquid TiCl_4 agree well with those obtained by the calorimetric procedure, and the values obtained by both methods substantiate Thomsen's measurements. From these experiments the entropy of gaseous TiCl_4 is 124 cal/ $^\circ\text{K}$ /mol at 1100°K . (auth)

573 MCC-1023-TR-162

California. Univ., Los Angeles.

I. REDUCTION OF BORON TRICHLORIDE BY CALCIUM HYDRIDE. II. PREPARATION OF CALCIUM TETRAMETHOXYBOROHYDRIDE, AND ITS REACTION WITH DIBORANE (thesis). Bruce Griggs. June 1955. 60p. [For Olin Mathieson Chemical Corp. Contract NOa(s) 52-1023-c].

The reaction of CaH_2 and BCl_3 in a LiCl-AlCl_3 (30 mol % LiCl) melt was investigated at about 150°C . An examination of the volatile reaction products showed a 37% yield of B_2H_6 based on the CaH_2 used and the equation, $3\text{CaH}_2 + 2\text{BCl}_3 = \text{B}_2\text{H}_6 + 3\text{CaCl}_2$. The reaction of B_2H_6 with the addition compound $\text{Ca}[\text{B}(\text{OCH}_3)_4]_2$ to form $\text{Ca}(\text{BH}_4)_2$ was also investigated. No $\text{Ca}(\text{BH}_4)_2$ was separated from the reaction products. (C.W.H.)

574 MCC-1023-TR-164

California. Univ., Los Angeles.

STUDIES ON THE PREPARATION OF CALCIUM BOROHYDRIDE, AND ON ALUMINUM CHLORIDE ETHERATE. Final Report. Hosmer W. Stone, Robert L. Pecsok, E. F. C. Cain, Robert Green, Bruce Griggs, Robert Meeker, Donald Nail, Irving Pearson, and Morey Ring. July 30, 1955. 20p. [For Olin Mathieson Chemical Corp. Contract NOa(s) 52-1023-c].

The pressure-bomb technique appears to be feasible for the preparation of $\text{Ca}(\text{BH}_4)_2$ by the reaction of $\text{B}(\text{OCH}_3)_3$ with CaH_2 . The metathesis of $\text{Ca}(\text{BH}_4)_2$ from NaBH_4 was attempted in organic solvents and by ion exchange with

water as a solvent. The vapor pressure of $\text{AlCl}_3\text{-O}(\text{C}_2\text{H}_5)_2$ was determined between 94 and 144°C; the melting point of the etherate was determined to be $39.4 \pm 0.2^\circ\text{C}$. (C.W.H.)

575 NP-5794

Iowa State Coll., Ames.

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Progress Report for July 1, 1955 to September 30, 1955. Henry Gilman. 41p. Contract AF33(616)-94.

The preparation of derivatives of phenoxasilin and phenothiasilin is described. Mechanisms for the reactions between organic lithium compounds and haloorganic compounds are discussed. (For preceding period see NP-5703.) (C.W.H.)

576 NP-5811

Mine Safety Appliances Co., Callery, Penna.

WETTING WITH SODIUM. Technical Report No. 43.

M. H. Wahl. Nov. 7, 1955. 13p. Contract NObs-65426.

Certain pretreatments (aqua regia, NaOH, electropolish, and Na_2PO_4) have been shown to enhance wetting of stainless steel by molten Na at low temperatures. Wetting was neither speeded nor retarded by contact with cover gas (98% N_2 -2% O_2). (C.W.H.)

577 NRL-4536

Naval Research Lab., Washington, D. C.

SOME FACTORS AFFECTING THE DECOMPOSITION OF HYDRAZINE IN LIQUID AMMONIA. J. P. Redmond and J. A. Krynitsky. Apr. 11, 1955. 23p. Project Nos. NR 601-050 and NA-770-109.

The influences of soluble KNH_2 and insoluble K_2SO_4 on the stability of N_2H_4 in liquid NH_3 were studied. The decomposition was found to be a heterogeneous catalyzed reaction. Alkaline liquid NH_3 solutions of free N_2H_4 were stable over a 72-hour measured period but decomposed in the presence of K_2SO_4 to yield hydrogen and nitrogen in a 2 to 1 ratio. The form or the available surface area of the K_2SO_4 had a direct effect on the rate of decomposition. The alkalinity of the solution was significant in the results. Hydrazine was found to be stable in acidic or essentially neutral liquid NH_3 solutions with or without the presence of such catalysts as K_2SO_4 or graphite. In alkaline homogeneous solutions, N_2H_4 was found to be stable. (auth)

578 NYO-3108

Columbia Univ., New York. School of Mines.

PHYSICAL CHEMICAL PROPERTIES OF THE SYSTEMS NaCl-ZrCl_4 , KCl-ZrCl_4 AND NaCl-KCl-ZrCl_4 .

SUMMARY REPORT. H. H. Kellogg, L. J. Howell, and R. C. Sommer. Apr. 7, 1955. 62p. Contract AT(30-1)-1135.

The phase diagrams of the low melting portions of the NaCl-ZrCl_4 and KCl-ZrCl_4 systems have been determined. The vapor pressure of ZrCl_4 over these melts has been measured as a function of melt composition and temperature. Phase studies have been initiated on the NaCl-KCl-ZrCl_4 system. It has been shown that Zr metal is attacked by ZrCl_4 vapor and by NaCl-ZrCl_4 melts, with the production of ZrCl_2 and ZrCl_3 . The electrical conductivity of the NaCl-ZrCl_4 has also been determined. (C.W.H.)

579 ORNL-887

Oak Ridge National Lab., Tenn.

THE PREPARATION OF TRI-n-BUTYL PHOSPHATE P^{32} .

W. H. Baldwin and C. E. Higgins. Feb. 5, 1951. Decl. Oct. 4, 1955. 5p. Contract W-7405-eng-26.

The preparation of esters by the metathetical reaction between the silver salt of an acid and an alkyl halide, though usually considered a time-consuming and expensive method, is useful in specific applications. Since radio-active phosphorus, P^{32} , is readily available in high specific activity as orthophosphoric acid, the most direct method of synthesis of tri-n-butyl phosphate- P^{32} seemed to be through the reaction of silver phosphate with excess n-butyl bromide. For synthetic purposes it appears satisfactory to precipitate the phosphate quantitatively with a slight excess of silver without sacrificing the yield of ester. (auth)

580 ORO-146

Duke Univ., Durham, N. C.

ELECTROMOTIVE FORCE MEASUREMENTS OF CELL REACTIONS IN FUSED SALT SOLVENTS. [Annual] Report.

Douglas G. Hill and Arthur S. Gillespie, Jr. Sept. 15, 1954. 12p. Contract AT(40-1)-1526.

Electromotive force measurements of the iron-iron oxide electrode in $\text{Li}_2\text{SO}_4\text{-K}_2\text{SO}_4$ systems are reported. Pre-oxidation of the Fe increases the potential of the air, iron-iron oxide cell but has little effect on the potential of the oxygen, iron-iron oxide cell. It appears that the Pt electrodes are poisoned by the cell reactions. (C.W.H.)

581 UCLA-343

California. Univ., Los Angeles. Atomic Energy Project. ULTRACENTRIFUGATION ANALYSIS OF ASYMMETRIC HIGH POLYMER POLYELECTROLYTES, DESOXYRIBONUCLEATE AND HYALURONATE. Norman S. Simmons. Sept. 6, 1955. 18p. Contract AT-04-1-GEN-12.

A technique is described for the measurement of the sedimentation constant of asymmetric high polymer polyelectrolytes. Difficulties due to the marked concentration dependence of the rate of sedimentation are obviated by the simple expedient of plotting the changing rate of sedimentation against the average distance of the peaks from the center of rotation (X_m). The plot is then extrapolated to the distance of the meniscus from the center of rotation. This gives the sedimentation rate at the start of the run when the concentration is known with ambiguity. Because of the hypersharp schlieren peaks observed, two concentrations (in two cells—the balance cell omitted) may be run simultaneously. Thus, the slope of the S vs. C plot may be obtained under identical conditions of temperature, time and rotational velocity. Minor modifications are made in the optics of the ultracentrifuge, permitting very low concentrations to be measured with the usual schlieren system. (auth)

582 UCRL-3132

California. Univ., Berkeley. Radiation Lab.

KINETICS OF THE HYDROLYSIS OF N-TRIFLUOROACETYLAMINO ACIDS. Rosemarie Ostwald. Sept. 23, 1955. 19p. Contract W-7405-eng-48.

The order of reaction, rate constants, and activation energies for the alkaline hydrolysis of N-trifluoroacetyl-glycine, -tryptophan, -phenylalanine, -norleucine, -valine, -ε-aminocaproic acid, and -lysine, were determined. The activation energies were found to be all in the same range. The reaction is second order for all compounds except for N-trifluoroacetyllysine. The hydrolysis of N-trifluoroacetyllysine was found to be complicated. A hypothesis for the mechanism of this reaction is suggested. (auth)

583 UCRL-3144

California. Univ., Berkeley. Radiation Lab.
GASEOUS MOLYBDENUM OXYCHLORIDE. Neilen
Hultgren and Leo Brewer. Sept. 1955. 11p. Contract
W-7405-eng-48.

The reaction of MoO_3 with HCl was studied and the formation of the gaseous molecule MoO_2Cl_2 demonstrated. (auth)

584 WADC-TR-52-5, WADC-TR-52-5(Suppl.1), and WADC-TR-52-5(Suppl.2)

Shell Development Co., Emeryville, Calif.

HIGH STRENGTH EPON LAMINATES. F. C. Hopper and D. W. Elam. Jan. 1952. 51p. SUPPLEMENT 1. Sept. 1952. 28p. (ATI-156652). SUPPLEMENT 2. F. C. Hopper. Mar. 1954. 71p. (AD-33351).

WADC-TR-52-5 and WADC-TR-52-5(Suppl.1) are bound together. WADC-TR-52-5(Suppl.2) is bound separately.

A laminate made from glass fabric and Epon 1001 resin cured with dicyandiamide was found to have a flexural strength of 76,000 psi at room temperature and 76,200 psi at 160°F. The Epon resins were found to be capable of producing laminates with higher mechanical strength at room temperature than types of low-pressure laminating resins. Laminates, with good strength at room and elevated temperatures after short-time exposure, were obtained from mixtures of one part Epon 1001 with two parts of Plyphen 5023, cured with dicyandiamide and using 181-Volan A glass fabric. (J.E.D.)

585 WADC-TR-52-5(Suppl.3)

Shell Development Co., Emeryville, Calif.

HIGH STRENGTH EPON LAMINATES. Frank C. Hopper. Apr. 1955. 130p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS; Task title: STRUCTURAL PLASTICS. Contract AF 33(038)-19587. (AD-66441)

This report covers work during the period Sept. 1953 to Sept. 1954 and summarizes previous work from Feb. 1951.

An accurate account of the present status of research on EPON resin laminates is presented. Wet and dry laminating systems are described. Wet systems based on EPON 828 yield laminates with exceptional flexural and compressive strengths at room temperature. Resistance to water and solvents is excellent. Strength retention at elevated temperatures up to 300°F is good. Dry laminating systems offer good strength from room temperature to 500°F. Laminates made from EPON X-12100 cured with Curing Agents E or F retain up to 36,000 psi flexural strength at 500°F after aging 200 hr at 500°F. Even stronger after short exposure to 500°F, but less resistant to aging at that temperature, is a mixture of EPON 1001 with Plyphen 5023 (a phenolic resin) cured with dicyandiamide. (auth)

586 WADC-TR-54-185(Pt.II)

Naval Research Lab., Washington, D. C.

THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. PART II. HIGH TEMPERATURE REACTION OF SODIUM HYDROXIDE. Dale D. Williams and R. R. Miller. Feb. 1955. 64p. Project No. 1252. Task title: MOLTEN METALS. Contract MIPR AF 33(616)-54-102.

The reactions between molten NaOH and Ni and other container materials have been investigated in the temperature range 700 to 900°C. The general equation for the primary reaction occurring is: $\text{NaOH} + \text{Metal} = \text{Na}_2\text{O} + \text{Metal oxide} + \text{H}_2$. In static systems, Ni may be used as a

container for molten NaOH at temperatures to 1000°C with H_2 protection. (C.W.H.)

587 WIN-25

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF THORNBURG LOS OCHOS ORE. E. S. Porter, P. N. Thomas, H. I. Viklund, and G. Trueman. Oct. 17, 1955. 31p. Contract AT(49-6)-924.

Laboratory investigations were made of three samples of uranium ore from the Los Ochos lease of the Thornburg Mining Company. The amenability of the ore to acid and carbonate leaching was studied as well as methods of recovering the uranium from acid leach solutions. (auth)

588 AEC-tr-2328

KINETICS OF THE REACTION OF CALCIUM WITH NITROGEN. V. A. Shushunov and Yu. N. Baryshnikov. Translated from *Zhur. Fiz. Khim.* 27, 703-12(1953). 20p.

The reaction between Ca and N_2 ($3\text{Ca} + \text{N}_2 = \text{Ca}_3\text{N}_2$) takes place autocatalytically at temperatures up to 420°C. The activation energy for the reaction is estimated to be 23,000 calories/mole. Two critical temperature values were obtained for the reaction, which indicated the formation of unstable intermediate compounds. (C.W.H.)

589 TT-561

OXIDATION OF ADSORBED MOLECULES OF CARBON MONOXIDE BY ATOMS OF OXYGEN. (Okislenii Adsorbirovannykh Molekul Okisi Ugleroda Atomarnym Kislorogom). M. M. Pavliuchenko. Translated by D. G. H. Marsden from *Zhur. Fiz. Khim.* 14, 605-14(1940). 18p.

The oxidation of CO by oxygen atoms is heterogeneous and occurs by collision of gas-phase oxygen atoms with adsorbed CO molecules. It is shown that with the exception of Pt at room temperatures, oxygen atoms adsorbed on Ag and quartz do not react with CO either at liquid-air or room temperatures. The activation energy of the reaction $\text{O} + \text{CO}$ is zero. (auth)

590

TRACER-DIFFUSION IN LIQUIDS. V. SELF-DIFFUSION OF ISOELECTRIC GLYCINE IN AQUEOUS GLYCINE SOLUTIONS. Jui H. Wang (Yale Univ., New Haven, Conn.). *J. Am. Chem. Soc.* 75, 2777-8(1953) June 5.

The self-diffusion coefficients of isoelectric glycine in its aqueous solutions were measured at 25°C. The dependence of the coefficients on the glycine concentration in dilute solutions is discussed. (C.W.H.)

591

POTENTIOMETRIC TITRATIONS IN LIQUID AMMONIA. IX. REDUCTION OF IODIDES OF ZINC, CADMIUM, AND MERCURY. George W. Watt and Philip S. Gentile (Univ. of Texas, Austin). *J. Am. Chem. Soc.* 77, 5462-5(1955) Nov. 5.

Potentiometric titration of the iodides of Zn^{2+} , Cd^{2+} , and Hg^{2+} with K in liquid NH_3 shows only the reduction to the corresponding elemental metals and provides no evidence for the intermediation of the +1 oxidation states of these metals. From related titrations involving higher ratios of reductant to salt, evidence for the formation of the intermetallic compounds KCd_3 , KHg and KHg_2 was obtained. The anticipated KZn_4 was not detected. (auth)

592

THE DETERMINATION OF THE BISULFATE DISSOCIATION QUOTIENT FROM POTENTIOMETRIC MEASURE-

MENTS. Eugene Eichler and Sherman Ribideau (Los Alamos Scientific Lab., N. Mex.). *J. Am. Chem. Soc.* **77**, 5501-2(1955) Nov. 5.

The mean values of the bisulfate dissociation quotient obtained in perchlorate solutions of unit ionic strength in 0.01, 0.10, and 1.0M HClO_4 were 0.095, 0.084, and 0.30 respectively. (C.W.H.)

593

INVESTIGATION OF ELECTRICAL CONDUCTIVITY IN THE BERYLLIUM CHLORIDE-SODIUM CHLORIDE SYSTEMS. Yu. K. Delimarskii, I. N. Sheiko, and V. G. Feshchenko. (Kiev Inst. of General and Inorganic Chemistry). *Zhur. Fiz. Khim.* **29**, 1499-1507(1955) Aug. (In Russian).

Evaluation of electrical conductivity in the BeCl_2 -NaCl system in the temperature interval 250 to 500 $^\circ\text{C}$ was made. The electrical conductivity of pure BeCl_2 in the interval 445 to 488 $^\circ\text{C}$ was measured with subsequent evaluation of the activating energy and degrees of electrical dissociation of molten BeCl_2 . (R.V.J.)

594

OXYGEN-18 ISOTOPE EFFECT IN THE REACTION OF OXYGEN WITH COPPER. Richard B. Bernstein (Univ. of Michigan, Ann Arbor). *J. Chem. Phys.* **23**, 1797-1802 (1955) Oct.

The fractionation of O^{18} in the reaction of Cu with O_2 of natural isotopic composition has been measured over the temperature range 68 to 256 $^\circ\text{C}$. The oxide films (estimated thicknesses varying from 150 to 2500 Å) were removed for O^{18} assay by treatment with H_2 at 350 $^\circ\text{C}$. Using the CO_2 equilibration technique, the $\text{O}^{18}/\text{O}^{16}$ ratios for the resulting water samples were determined mass spectrometrically and compared with the ratio for a reference sample of water prepared from the original O_2 . The direction of the fractionation indicated that O_2^{16} reacts preferentially compared to $\text{O}^{16}\text{O}^{18}$. The isotope effect appeared to be independent of the oxygen pressure over the limited range studied (2 to 25 cm Hg). The magnitude of the fractionation factor was 2.0% at 150 $^\circ\text{C}$, with a small negative temperature coefficient. From this it was possible to estimate a value of $\Delta E_{\text{act}} = 17$ cal/mole, which may be compared with the calculated isotopic zero-point energy difference of 64 cal/mole. The theoretical implications of the experimental results are discussed. (auth)

595

INJECTION OF ACTIVATORS INTO ZnS PHOSPHORS BY DIFFUSION. N. Ril and G. Ortman. *Zhur. Obshchei Khim.* **25**, 1693-1700(1955) Sept. (In Russian)

Diffusion and migration of copper activators in ZnS crystals, and ZnS spectral luminescence under various temperatures were studied. (R.V.J.)

596

DOUBLE DECOMPOSITION IN ABSENCE OF A SOLVENT. INTERSYSTEM OF LITHIUM AND POTASSIUM SULPHATES AND METABORATES. A. G. Bergman, A. I. Kislova and V. I. Posypaiko. (Rostov-on-Don State Univ.) *Zhur. Obshchei Khim.* **25**, 1890-9(1955) Oct. (In Russian)

A visual-polythermal method was applied in the study of the liquidus diagram for the Li_2SO_4 , LiBO_2 , K_2SO_4 , Li_2SO_4 triple interaction systems and its binary components Li_2SO_4 - $\text{Li}_2(\text{BO}_2)_2$ and K_2SO_4 - $\text{K}_2(\text{BO}_2)_2$. (R.V.J.)

597

DRY CELL WITH RADIOACTIVE SOLID ELECTROLYTE.

Shun-ichi Satoh and Koshin Yamane. *J. Sci. Research Inst. (Tokyo)* **49**, 241-2(1955) Sept.

The use of thorium nitride, Th_3N_4 , as the radioactive solid electrolyte in a dry cell is demonstrated. (C.W.H.)

598

ON REACTION OF HYDROGEN EXCHANGE IN ALDEHYDES SATURATED WITH DEUTERIOPHOSPHORIC ACID. V. N. Setkina and D. N. Kursanov. *Doklady Akad. Nauk S.S.S.R.* **103**, 631-4(1955) Aug. 1. (In Russian)

599

RADIUM DIFFUSION BETWEEN THE SOLUTION AND CRYSTALS OF POTASSIUM SULFATE. M. S. Merkulova and S. A. Potapova. (Moscow State Univ.) *Doklady Akad. Nauk S.S.S.R.* **103**, 643-5(1955) Aug. 1. (In Russian)

Capture of radium in crystallization of nonisomorphous salts was studied with the system K_2SO_4 - RaSO_4 - H_2O . (R.V.J.)

600

ON REACTION OF HYDROGEN EXCHANGE IN DIBASIC SATURATED CARBOXYLIC ACIDS. E. V. Bykova and V. N. Setkina. (Inst. of Elements and Organic Compounds). *Doklady Akad. Nauk S.S.S.R.* **103**, 835-7(1955) Aug. 11. (In Russian)

601

ON REACTIONS OF HYDROGEN EXCHANGE IN ALDEHYDES. D. N. Kursanov and Z. N. Parnes. (Inst. of Elements and Organic Compounds). *Doklady Akad. Nauk S.S.S.R.* **103**, 847-9(1955) Aug. 11. (In Russian)

602

SURFACE TENSION IN DILUTED-TO-CAPACITY AMALGAMS OF ALKALI METALS. P. P. Pugachevich and O. A. Timofeevicheva. (Kurnakov Inst. of General and Inorganic Chemistry.). *Doklady Akad. Nauk S.S.S.R.* **104**, 98-100(1955) Sept. 1. (In Russian)

The surface tension of 280 amalgams of sodium, potassium, and cesium containing from 6×10^{-8} to 0.13 wt.% dissolved metal was tested with improved apparatus. (R.V.J.)

603

PRODUCTION AND PURIFICATION OF TiCl_4 . L. W. Rowe and W. R. Opie (National Lead Co., South Amboy, N. J.). *J. Metals* **7**, 1189-93(1955) Nov.

A brief history of TiCl_4 production and purification is given. Chlorinator feed materials for the production of TiCl_4 are classified. The thermodynamics and kinetics of TiCl_4 production by chlorination of TiO_2 are discussed. Problems encountered in the chlorination and purification steps are outlined in detail. (auth)

Refer also to abstract 999.

ANALYTICAL PROCEDURES

604

AECD-3662

National Bureau of Standards, Washington, D. C. SEPARATION AND PREPARATION OF SAMPLES FOR SPECTROGRAPHIC ANALYSIS OF URANIUM BASE MATERIALS. WORK DONE MAY 1942-JUNE 1946. R. L. Barnard, C. J. Rodden, and J. P. Williams. Decl. with deletions Sept. 22, 1948. 11p.

Procedures are presented for the conversion of U and its compounds to U_3O_8 for spectrographic analysis and the

separation of rare-earth, refractory, and platinum group metals from U-base materials. (C.W.H.)

605 AERE-C/R-1637

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF URANIUM BY HIGH-PRECISION SPECTROPHOTOMETRY. A. Bacon and G. W. C. Milner. July 29, 1955. 33p.

A procedure is described for determining the U content of relatively pure samples of U_3O_8 and U metal with a (standard deviation) of $\pm 0.04\%$. The sample is dissolved in HNO_3 and this solution is then converted to standard conditions of acidity by evaporating to fumes of H_2SO_4 . After dilution with H_2O to a standard volume, the absorbancy of the sample solution is measured at 430 $m\mu$, using a reference solution of accurately known U content. The U content of the sample is then obtained either by referring the absorbancy difference to a calibration graph or by calculation using a factor derived from the calibration graph. (auth)

606 ANL-4509

Argonne National Lab., Lemont, Ill.

THE ANALYTICAL PROCEDURES OF THE BIOASSAY GROUP AT THE ARGONNE NATIONAL LABORATORY. Jack Schubert, Lawrence S. Myers, Jr., and Jean A. Jackson. Mar. 1951. Decl. June 30, 1955. 23p. Contract W-31-109-eng-38.

Analytical procedures are presented for the determination of gross α , Po, Pa, Ra, and tritium activity in samples of blood, urine, and feces. (C.H.)

607 BM-RI-5168

Bureau of Mines.

METHODS FOR ANALYZING TITANIUM SPONGE AND INTERMEDIATE PRODUCTS. P. R. Perry, R. W. Lewis, and T. A. Sullivan. Mar. 1955. 47p.

Chemical and spectrochemical procedures are outlined for the analysis of Ti, $TiCl_4$, Ti alloys, and intermediate materials and products. (C.W.H.)

608 HW-36831

Hanford Atomic Products Operation, Richland, Wash. THE PREPARATION OF FLUORIDE MELTS FOR USE IN THE FLUORIMETRIC METHOD OF URANIUM ANALYSIS. C. E. Michelson. July 11, 1955. 39p. Contract W-31-109-Eng-52.

It was demonstrated that the precision of results obtained with the fluorimetric method of U analysis is generally limited by the melt preparation rather than by instrumental variables. Among the factors in this melt preparation are fusion method, dish characteristics, contamination, sample variation, and flux and uranium distribution. The extent to which they affect the precision depends upon the control that can be applied to the factors as well as the U level involved. In the ideal range of the method, 10^{-6} to 10^{-7} g/dish, a precision of 5% can be readily attained; however, in the range of 5×10^{-11} g/dish, a precision of 40% requires great care. The classical method of avoiding the quenching problem by means of dilution appears to be the best solution to the problem; however, chemical separation or spike techniques may be required in certain cases. An alternative method of correction, based upon optical measurements, was studied. The fluorescence is read with the melt in a nonreflecting (black) dish and in a highly reflecting (bright) dish, and this ratio used to determine the extent of quenching. (auth)

609 ISC-584

Ames Lab., Ames, Iowa.

AMES LABORATORY ANALYTICAL PROCEDURES FOR DETERMINATION OF IMPURITIES IN CALCIUM METAL. Charles V. Banks and Bernard D. LaMont. Mar. 7, 1955. 17p. Contract W-7405-eng-82.

Analytical procedures for the determination of Al, Cr, Fe, Mn, Ni, N, and Si in Ca metal are discussed. (auth)

610 MIT-EBR-14

Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.

REPORT ON THE COOPERATIVE ANALYSIS OF THE SAMPLE OF ZIRCONIUM HYDRIDE M.I.T. (ZH-6). E. B. Read. Nov. 5, 1951. Decl. Aug. 11, 1955. 5p.

A report on the spectrographic analysis of ZrH_4 for Al content is reported. A tabulation of the results of the analysis is shown. (auth)

611 NYO-3606

Massachusetts Inst. of Tech., Cambridge. Lab. of Nuclear Science.

NEPHELOMETRIC DETERMINATION OF SULFATE IMPURITY IN REAGENT-GRADE SALTS. Hubert J. Kelly and L. B. Rogers. [1954]. 25p. Contract [AT(30-1)-905].

A nephelometric procedure involving the addition of solid $BaCl_2$ to HCl solutions of the sample containing alcohol has been developed for the determination of sulfate impurities in reagent-grade salts. (C.W.H.)

612 ORNL-1932

Oak Ridge National Lab., Tenn.

PROCEDURE FOR THE RADIOCHEMICAL ANALYSIS OF STRONTIUM AND BARIUM IN HUMAN URINE. Lawrence B. Farabee. Sept. 6, 1955. 22p. Contract W-7405-eng-26.

An analytical procedure for the determination of radioactive strontium and barium in large volumes of urine is described. The method is based on the preferential chelation of calcium over strontium using versene. This difference is greatest at a pH of 4.5 to 6.0. When a versenate chelate of the alkaline earths in a urine specimen, at a pH of 5.5, is passed over a cation exchange column, all of the strontium and barium is adsorbed, whereas almost all of the calcium and about $\frac{1}{2}$ of the magnesium passes into the effluent as the chelate. The extraneous calcium and magnesium can be removed from the resin with a solution of citric acid and versene at a pH of 5.0. The sodium is removed with 0.5N HCl, while the radioactive strontium and barium is eluted with 6N HNO_3 . (auth)

613 TID-5259

Battelle Memorial Inst., Columbus, Ohio.

MICRODETERMINATION OF TIN IN ZIRCONIUM-BASE ALLOYS. F. E. Huber, D. L. Chase, and E. J. Center. Jan. 31, 1952. Decl. Sept. 13, 1955. 6p.

A procedure for the microdetermination of Sn in Zr-base alloys is outlined. (J.E.D.)

614 UR-305

Rochester, N. Y. Univ. Atomic Energy Project.

ANALYTICAL AND AUTORADIOGRAPHIC METHODS FOR POLONIUM²¹⁰. Frank A. Smith, Rocco J. Della Rosa, and Louis J. Casarett. Aug. 24, 1955. 78p. Contract W-7401-eng-49.

Detailed descriptions are presented of procedures currently employed for sample preparation and the analyti-

cal and autoradiographic determination of Po^{210} in biological materials. Investigations of the quantitative effects of a number of factors affecting the measurement of Po are described. Statistical analyses of the influence of these factors and of the overall precision of the method, as well as structural features of the plating equipment used, are included. (auth)

615 Y-883

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

ANALYSIS OF URANYL FLUORIDE AND URANIUM TETRAFLUORIDE BY PYROHYDROLYSIS. J. O. Hibbits. July 2, 1952. Decl. Oct. 17, 1955. 13p. Contract W-7405-eng-26.

The rapid pyrohydrolysis of UO_2F_2 and UF_4 and the high solubility of HF in water suggested that a comparatively easy analysis might be accomplished. A method was developed in which the salt is pyrohydrolyzed to liberate HF and produce an oxide. The liberated HF is condensed and titrated, and the oxide is converted completely to U_3O_8 and weighed; additional muffling is required only for UF_4 . At the 95% confidence level the maximum limits of error for the fluorine and uranium were, respectively, $\pm 0.44\%$ and $\pm 0.17\%$. (auth)

616 Y-1095

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. URANIUM ANALYSIS BY MONOCHROMATIC X-RAY ABSORPTION. W. B. Wright, Jr. and R. E. Barringer. Aug. 26, 1955. 23p. Contract W-7405-eng-26.

It has been shown previously that a quantitative measurement of the uranium concentration of a solution can be made by x-ray absorption techniques. An equation of the form $C_u = F(I_1)$ was derived for the determination of U in the presence of impurities, where C_u is the concentration of U per unit volume and $F(I_1)$ is a known function of measured x-ray intensities. An evaluation of this technique for routine uranium analysis is presented. (auth)

617

SPECTROCHEMICAL DETERMINATION OF BORON IN CARBON AND GRAPHITE. Cyrus Feldman and Janus Y. Ellenburg (Oak Ridge National Lab., Tenn.). Anal. Chem. 27, 1714-21(1955) Nov.

A method for the spectrochemical determination of trace amounts of B in carbon and graphite, based on the volatility behavior of B in a direct current arc as compared with Ir, is described. (C.W.H.)

618

DEHYDRATION OF ORTHOPHOSPHORIC ACID. Cecil E. Higgins and Willis H. Baldwin (Oak Ridge National Lab., Tenn.). Anal. Chem. 27, 1780-3(1955) Nov.

A method combining P^{32} -labeling with selective elution from anion exchange resins is described for the separation and identification of phosphates resulting from the dehydration of H_3PO_4 . (C.W.H.)

619

FLAME PHOTOMETRY OF ORGANIC PHOSPHORUS. D. W. Brite (Hanford Atomic Products Operation, Richland, Wash.). Anal. Chem. 27, 1815-16(1955) Nov.

A rapid method for determining phosphorus based upon flame emission measurement at 540 m μ was developed, and representative organic phosphorus compounds in alcoholic solution were determined in the range 0.01 to 0.03M with an average error of 0.0006M. Na and Ca cause positive

errors because of interfering emission. N_2 , S, I_2 , and Cl_2 do not interfere at concentrations equivalent to that of the P. (auth)

620

GRAVIMETRIC AND TITRIMETRIC DETERMINATION OF TITANIUM, ZIRCONIUM, AND HAFNIUM WITH CUPFERRON. APPLICATION TO FLUORIDE SOLUTION. Philip J. Elving and Edward C. Olson (Univ. of Michigan, Ann Arbor). Anal. Chem. 27, 1817-20(1955) Nov.

The gravimetric and titrimetric determination of Ti, Zr, and Hf by precipitation with cupferron (N-nitrosophenylhydroxylamine) in 10% sulfuric acid has been investigated. The metals can be titrated with a precision of better than 0.3% when employing amperometric equivalence point detection. Fluoride, phosphate, and other complexing species do not interfere. The ready titrability of suspended zirconium and hafnium phosphates indicates a rapid way of completing the analysis after separation of the metals as the phosphate from sulfuric acid-hydrogen peroxide solution. (auth)

621

SEPARATION OF TRACES OF BORON BY EXTRACTION FROM TETRAPHENYLARSONIUM FLUOROBORATE. J. Coursier, J. Hure, and R. Platzter (Commissariat a l'Energie Atomique, Saclay, France). Anal. Chim. Acta 13, 379-86(1955) Oct. (In French)

The separation of boron traces by extraction with tetraphenylarsonium fluoborate, using CHCl_3 , is described. The determination of boron is then carried out by the Philipson method. (auth)

622

THE SEPARATION AND QUANTITATIVE DETERMINATION OF PLATINUM, PALLADIUM, RHODIUM, AND IRIDIUM ON PAPER STRIPS. N. F. Kember and R. A. Wells (Chemical Research Lab., Teddington, Middlesex, England). Analyst 80, 735-51(1955) Oct.

Chromatographic methods are described for the separation of Pt, Pd, Rh, and Ir in microgram amounts on paper strips. After separation, the metals are extracted from the sections of the strips, and the Pt, Pd, and Rh are determined by colorimetric methods and the Ir by microtitration. Analyses have been carried out by this technique on mixtures of all four metals containing large amounts of base metals. (auth)

623

DETERMINATION OF SPECIFIC ACTIVITY OF SODIUM IN BONE. Gilbert B. Forbes and Anne Lewis (Univ. of Rochester School of Medicine and Dentistry, New York). Proc. Soc. Exptl. Biol. Med. 90, 178-81(1955) Oct.

A new method for the determination of specific activity of sodium in bone is presented. The method consists of placing a solution of bone ash on a cation exchange column. Elution with acid results in the quantitative recovery of both stable and radioactive sodium in a certain fraction of the eluate; this fraction is free from P, K, Mg and Ca and can be easily analyzed for both sodium and radiosodium. (auth)

624

DETERMINATION OF GRAPHITIC AND AMORPHOUS CARBON. P. L. Walker, Jr., J. F. Rakszawski, and A. F. Amington (Pennsylvania State Univ., State College). ASTM Bull. No. 208, 52-4(1955) Sept.

An x-ray-diffraction technique is used to distinguish carbon and graphite in an integral mixture. (C. H.)

625

HAEMATOTOXYLIN (OXIDIZED)—A COLORIMETRIC REAGENT FOR LANTHANUM AND YTTRIUM. T. P. Sarma and Bh. S. V. Raghava Rao (Andhra Univ., Waltair, India). *J. Sci. Ind. Research (India)* **14B**, 450-3(1955) Sept.

A colorimetric method is described for the estimation of small amounts of La and Y in aqueous solutions based on the reactions of these elements with haematotoxilin (oxidized) to form colored complexes, which absorb at 650 and 600 m μ , respectively. (C.W.H.)

Refer also to abstracts 860, 875, and 1128.

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

626

CALCULATION OF ATOM RADII FOR MENDELEEV'S ELEMENT. N. E. Zaez. (Voroshilov's Research Inst.). *Zhur. Obshchei Khim.* **25**, 1844-59(1955) Sept. (In Russian)

Calculation of atom radii was made according to Mendeleev's method. Satisfactory results for 60 elements, less satisfactory for 14 elements and completely unsatisfactory for 10 elements were obtained for 98 elements tested. Lack of initial data for Gd, Ac, Am, At, Cm, Np, Pu, Po, Pm, Pa, Fr, Te, Bk, and Cf prevented calculation for their radii. Tables comparing the calculated and the experimental data are presented. (R. V. J.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

627 WAL-401/245

Watertown Arsenal Lab., Mass.

METALLOGRAPHIC IDENTIFICATION AND CRYSTAL SYMMETRY OF TITANIUM HYDRIDE. (First Partial Report on Hydrogen in Titanium). L. D. Jaffe. Nov. 17, 1954. 4p. DA Project No. 593-08-021.

Specimens of titanium containing varying amounts of hydrogen in the form of titanium hydride, were examined metallographically under polarized and sensitive-tint illumination. X-ray and neutron-diffraction studies were also conducted to verify the metallographic results. Metallographic identification of titanium hydride may be facilitated by the strong color change occurring when this phase is rotated under sensitive-tint illumination. Titanium hydride is not face-centered cubic, as previously reported, but probably tetragonal. (auth)

Refer also to abstracts 741, 743, 753, and 910.

DEUTERIUM AND DEUTERIUM COMPOUNDS

628 CRE-374

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE PRODUCTION OF HEAVY WATER AT TRAIL, B. C. E. A. Barlow. Mar. 8, 1948. Decl. Feb. 22, 1955. 17p. (AECL-163)

The heavy water plant was built as an addition to an electrolytic hydrogen production plant. The combined plants consist of 3 parts: a primary plant of 4 stages including the original electrolytic H plant plus certain modifications and the catalytic exchange towers; a

secondary plant of 3 stages built especially for D₂O production; and a control laboratory. The plants are described, and flowsheets and typical operating data are presented. (M.P.G.)

629 UCRL-3169

California. Univ., Berkeley. Radiation Lab.

INDEX OF REFRACTION AND LIQUID-VAPOR EQUILIBRIA FOR DEUTERIUM-NITROGEN MIXTURES. Arturo Maimoni and Donald N. Hanson. Oct. 19, 1955. 16p. Contract W-7405-eng-48.

Data on index of refraction and liquid-vapor equilibrium for deuterium-nitrogen mixtures are presented and compared with the corresponding values for the hydrogen-nitrogen system. The index of refraction of deuterium for white light is slightly smaller than that of hydrogen: 1.80×10^{-6} index of refraction unit. The index of refraction of deuterium-nitrogen mixtures is almost linear with composition and can be calculated within the limits of experimental error from the Lorentz-Lorentz molar refraction by using values of gas density corrected for the known deviations from ideal mixing behaviour. Deuterium is slightly more soluble in liquid nitrogen than hydrogen; the relative volatility is 1.198 at 90°K and about 1.177 at 95°K. The relative volatility is practically independent of pressure. Thus, at 90°K, the relative volatility decreases from 1.198 at 100 psia to 1.196 at 1000 psia, but this range of values is well within the experimental error. (auth)

630

SYNTHESIS OF METHYL-D₃ ALCOHOL AND METHYL-D₃ FLUORIDE. Walter F. Edgell and L. Parts (Purdue Univ., Lafayette, Ind.). *J. Am. Chem. Soc.* **77**, 5515-17(1955) Nov. 5.

Methanol-d₃ can be synthesized by the reduction of 1,2-propylene carbonate with lithium aluminum deuteride, and can be converted to methyl-d₃ p-toluenesulfonate, which on reaction with potassium yields methyl-d₃ fluoride. (C.W.H.)

631

THE EFFECT OF INHIBITORS ON THE HYDROGEN-DEUTERIUM EXCHANGE REACTION. M. J. Stephen and C. J. Danby (Univ. of Oxford, England). *Proc. Roy. Soc. (London)* **A232**, 271-7(1955) Oct. 25.

The exchange reaction between hydrogen and deuterium in silica vessels at temperatures in the region of 560°C has been studied, the rate of formation of HD being determined by mass-spectrometer analysis. Nitric oxide and propylene are effective inhibitors of the reaction: both reduce the rate to the same limit. The fully inhibited reaction is approximately of the first order, its activation energy is about 19,000 kcal/g.mol. and in packed vessels the rate is roughly proportional to the ratio of surface to volume. This residual reaction, unlike that in hydrocarbon pyrolysis, seems therefore to be almost entirely heterogeneous, all gas-phase reaction having been suppressed. These results and their bearing on the use of nitric oxide and olefines for the inhibition of chain reactions are discussed. (auth)

Refer also to abstract 1124.

FLUORINE AND FLUORINE COMPOUNDS

632 AECU-3095

Michigan State Coll., East Lansing. Kedzie Chemical Lab. PHYSICAL PROPERTIES OF THE HALOGEN FLUORIDES.

IV. THE IODINE PENTAFLUORIDE-HYDROGEN FLUORIDE SYSTEM. SOLID-LIQUID EQUILIBRIA, VAPOR PRESSURES, MOLAR VOLUMES, AND SPECIFIC CONDUCTANCES. Max T. Rogers, John L. Speirs, and Morton B. Panish. [1955?]. 11p. Contract AT(11-1)-151.

Some properties of the IF_5 -HF system have been investigated. The solid-liquid phase diagram shows a eutectic point at -83.49°C and 99.5 mol % HF. The vapor pressures at 15°C show positive deviations from Raoult's law, but no maximum vapor pressure was observed. There is a small decrease in volume on mixing, the maximum deviation from ideality being 6.6% at 90 mol % HF. The specific conductance of pure IF_5 at 25°C is 5.4×10^{-6} ohm/cm. The specific and molar conductances of mixtures of IF_5 and HF have been measured over the entire concentration range. (auth)

633 AECU-3097

Michigan State Coll., East Lansing. Kedzie Chemical Lab. PHYSICAL PROPERTIES OF THE HALOGEN FLUORIDES. VI. THE CHLORINE TRIFLUORIDE-HYDROGEN FLUORIDE SYSTEM. SOME VAPOR PRESSURE AND CONDUCTANCE MEASUREMENTS. Max T. Rogers, John L. Speirs, and Morton B. Panish. [1955]. 3p. Contract AT(11-1)-151.

The specific conductances of ClF_3 and of various solutions of HF in ClF_3 were measured at 25 and -78°C . Phase studies of the system, HF- ClF_3 , indicated the presence of an azeotropic mixture (60 ± 10 mol % HF) with maximum vapor pressure. (C.W.H.)

634 ISC-634

Ames Lab., Ames, Iowa. CONVERSION OF ZIRCONIUM SULFATES TO ANHYDROUS ZIRCONIUM TETRAFLUORIDE. G. H. Beyer, E. L. Koerner, and E. H. Olson. Aug. 18, 1955. 27p. Contract W-7405-eng-82.

635 NP-5809

Stanford Research Inst., Menlo Park, Calif. THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. Report No. 4. Bimonthly Progress Report for August-September 1955. A. P. Brady. Oct. 10, 1955. 7p. SRI Project No. CU-1102. Contract AF 33(616)-2558.

The absolute entropies, heats of formation, and free energies of formation of selected salts in the temperature range of 800 to 1900°F are determined. Assembling and testing of apparatus for measuring heat capacities from about 50°K to room temperature has been completed, including calibration of thermocouples by comparison with a platinum and with a copper resistance thermometer. This apparatus has been used to determine the absolute entropy of molybdenum hexafluoride vapor at 298.16°K . The result, 79.7 ± 0.6 cal/mole $^\circ\text{C}$, agrees well with that calculated from its spectrum, 80.05 cal/mole $^\circ\text{C}$. A solution calorimeter has also been assembled and tested. By comparing the heat of solution in aqueous sodium hydroxide of molybdenum hexafluoride with that of the oxide, the ΔH of formation of the fluoride was found to be -392.2 cal/mole at 298.16°K . These data, together with other data extant in the literature, allow calculation of the desired thermodynamic functions over the temperature range of interest. (For preceding period see NP-5685.) (auth)

636 NYO-1326

Mallinckrodt Chemical Works, St. Louis. EQUILIBRIUM LIQUID AND VAPOR COMPOSITION IN THE SYSTEM $\text{HF}-\text{SO}_2$. E. G. Schmieding and J. W. Stevenson. [nd]. Decl. Nov. 2, 1955. 7p.

Data on the equilibrium vapor and liquid compositions of the system $\text{HF}-\text{SO}_2$ are presented for atmospheric pressure and for 20 psig. A description of the experimental and analytical methods is given and an estimate of the reliability of the data is made. (auth)

637

THE CHEMICAL STATE OF F^{18} FROM THE FAST NEUTRON IRRADIATION OF FLUOROBENZENE. A. H. W. Aten, Jr., Beatrix Koch, and J. Kommandeur (Amsterdam, Holland). *J. Am. Chem. Soc.* **77**, 5498-9(1955) Nov. 5.

Fluorobenzene, in the presence of HF (<1%), was irradiated with fast neutrons. The fraction of the resultant F^{18} activity found in the organic compound was 0.36. (C.W.H.)

638

TRIPLE INTERACTION OF LITHIUM AND CALCIUM FLUORIDES AND SILICATES SYSTEMS. A. G. Bergman and N. A. Bychkova (Rostov-on-Don State Univ.) *Zhur. Obshchei Khim.* **25**, 1876-90(1955) Oct. (In Russian)

A visual-polythermal method was used in the investigation of the liquidus surfaces of the binary systems $\text{Li}_2\text{F}_2-\text{Li}_2\text{SiO}_3$, $\text{Li}_2\text{SiO}_3-\text{CaSiO}_3$, $\text{Li}_2\text{F}_2-\text{CaF}_2$ and the crystallization surfaces of Li_2F_2 , CaF_2 , LiSiO_3 , CaSiO_3 triple inter-systems. The method proved feasible in studies of silicates and silicate-saliferous systems. Diagrams and tables of experiments are given. (R.V.J.)

639

COMPLEX FORMATION AND INTERDECOMPOSITION IN INTERACTION SYSTEMS OF SODIUM AND POTASSIUM TITANATES AND FLUORIDES. M. L. Sholokhov. (Rostov-on-Don State Univ.) *Zhur. Obshchei Khim.* **25**, 1900-7(1955) Oct. (In Russian)

Metatitanates of sodium and potassium were obtained. Melting diagrams of the interaction systems $\text{Na}_2\text{TiO}_3\cdot\text{K}_2\text{TiO}_3$ and $\text{Na}_2\text{TiO}_3\cdot\text{NaF}$ were investigated by visual-polythermal melting methods. Studies established that combinations of sodium titanates and potassium titanates in the ratio of 1:1 melt without decomposition at 906°C . Sodium titanate and sodium fluoride in the combination $3\text{Na}_2\text{TiO}_3\cdot 2\text{NaF}$ melt without decomposition at 899°C . Boundaries of the crystallization zone inside the components, and combinations of $\text{Na}_2\text{TiO}_3\cdot\text{K}_2\text{TiO}_3$ and $3\text{Na}_2\text{TiO}_3\cdot 2\text{NaF}$ were established, and four triple non-variant points, of which one had eutectic properties and three transitory ones, were found. (tr-auth)

Refer also to abstracts 615 and 739.

GRAPHITE

640 NBS-D-106

National Bureau of Standards, Washington, D. C. THE ENERGY CONTENT OF IRRADIATED GRAPHITE SAMPLES. Edward J. Prosen and Dorothy R. Valent. Nov. 26, 1951. Decl. Sept. 22, 1955. 7p. NBS Project 3203.

Measurements of the energy content of irradiated graphite were made by the heat-of-combustion method. The energy contents were compared with the energy content of a standard sample of unirradiated graphite previously measured. (auth)

641

LATTICE CONSTANTS OF GRAPHITE AT LOW TEMPERATURES. Y. Baskin and L. Meyer (Univ. of Chicago). *Phys. Rev.* 100, 544(1955) Oct. 15.

The lattice constants of a graphite single crystal, natural graphite powder, and artificial graphite powder have been measured at 297°K, 78°K, and 4.2°K. The *a*-spacing does not change in this temperature range within the error of ± 0.0005 Å. The material with the greatest *c*-spacing showed between 297° and 78° the greatest change of *c*-spacing and the smallest change below 78°. The *c*-spacing of the artificial powder did not return to its original value at 297° after a thermal cycle, demonstrating irreversible deformation. (auth)

642

THEORY OF THE MAGNETIC SUSCEPTIBILITY OF GRAPHITE. John E. Hove (North American Aviation, Inc., Downey, Calif.). *Phys. Rev.* 100, 645-9(1955) Oct. 15.

The theory of the magnetic susceptibility of graphite is presented in terms of a three-dimensional Wallace electron energy band structure. The experimentally observed variation with temperature is explained in a satisfactory manner, provided the interplane resonance integral occurring in the band approximation is given a value of about 0.5 ev. This is about five times larger than the previously used estimate and implies that a two-dimensional band approximation may be invalid in many cases. The in-plane resonance integral is obtained by fitting the variation, with electron concentration, of the electrical resistivity of a graphite-bisulphate residue compound. In this way a value of 1.63 ev for this integral is obtained. It might be noted that these values enabled a better fit of the resistivity over the entire range of bisulphatization than could be obtained by a two-dimensional theory. On the other hand, the value thus obtained for the actual magnitude of the susceptibility is lower than that observed by a factor of about 40. The (room temperature) variation of the susceptibility of bromine graphite is then analyzed on the basis of the above theory, using the indicated values of the constants. In this way, a value is obtained for the percentage of the bromine which is ionized. This is found to be weakly dependent on the amount of bromine, varying between 18% at 0.3 atomic percent bromine to 13% at 0.8 atomic percent bromine. The experimental value has been found to vary slightly around 18%. This agreement is very good and indicates that the theory is valid in explaining relative variations of the susceptibility, even though there is difficulty in predicting the absolute magnitude. The latter is the only serious discrepancy found in the present work and has not yet been explained. (auth)

643

SPECIFIC HEAT OF GRAPHITE AT VERY LOW TEMPERATURES. Warren DeSorbo (General Electric Research Lab., Schenectady, N. Y.). *J. Chem. Phys.* 23, 1970-1(1955) Oct.

The specific heat of graphite has been measured in the temperature range, 1.5 to 20°K. (C.W.H.)

Refer also to abstract 624.

LABORATORIES AND EQUIPMENT

644 BNL-2183

Brookhaven National Lab., Upton, N. Y.
SOME PIECES OF EQUIPMENT DEVELOPED AT BROOKHAVEN NATIONAL LABORATORY. P. Richards and A. C. Rand. [1954]. 14p.

Equipment designs for hot lab application are shown and discussed. Bellows valves, manipulators, air samplers, mixer-heater units, pipette adaptors, and disc valves are included. (D.E.B.)

645 MLM-1022

Mound Labs., Miamisburg, Ohio.
A REMOTE CONTROLLED QUARTZ-FIBER MICRO-BALANCE: DESIGN, CONSTRUCTION, AND CHARACTERISTICS. (Information Report). R. G. Olt, H. R. DuFour, M. I. Gray, S. R. Orr, and J. H. Wright. Dec. 7, 1954. 32p. Contract AT-33-1-GEN-53.

Completely remote operation of an improved Kirk-Craig type of quartz-fiber microbalance is described. Weighings are performed within a vacuum-tight housing wherein the atmosphere may be controlled and duplicated. The reduction of health hazards associated with the measurement of radioactive samples, control of atmospheric effects on the samples, and increased speed and precision of weighing are some of the advantages gained from remote sample handling and from improvements in operating controls. The quality of the components of construction and the workmanship in the assembly of the balance are of paramount importance in developing a rugged, reliable instrument which is useful for routine mass determinations. (auth)

646

A VERSATILE HOT LAB FOR UNIVERSITY RESEARCH. W. W. Meinke, A. H. Emmons, and H. J. Gomberg (Univ. of Michigan, Ann Arbor). *Nucleonics* 13, No. 11, 76-9(1955) Nov.

Designs and floor plans are given for a university hot lab. The laboratory may be used for work with radiation of all levels. (B.J.H.)

647

A SIMPLE PERISCOPE SYSTEM FOR REMOTE OPERATIONS. A. G. Silvester (General Electric Co., Schenectady, N. Y.). *Nucleonics* 13, No. 11, 80-1(1955) Nov.

MOLECULAR STRUCTURE

648

THE BONDING OF THE HYDROGEN ATOM IN $\text{Co}(\text{CO})_4\text{H}$. Walter F. Edgell and Gordon Gallup (Purdue Univ., Lafayette, Ind.). *J. Am. Chem. Soc.* 77, 5762-3(1955) Nov. 5.

A molecular orbital treatment of the structure of $\text{Co}(\text{CO})_4\text{H}$ has shown the plausibility of the proposed "bridge structure" in the hydrogen atom bonding. (C.W.H.)

Refer also to abstract 994.

RADIATION CHEMISTRY

649

EFFECTS OF Co^{60} γ RADIATION ON HYDROPHOBIC COLLOID SOLUTIONS. V. F. Oreshko, N. G. Serebryakov,

and E. K. Sakseev. *Kolloid. Zhur.* 17, 579-86(1955) Sept.-Oct. (In Russian)

Co^{60} γ -radiation effects on hydrophobic colloidal solutions of gold and silver with negatively charged particles and silver iodide with negatively and positively charged particles were investigated. The Co^{60} γ radiation induced coagulation of positive sols and increased the stability of the negative sols. With Co^{60} irradiation dispersion of negative sols grows, especially with roughly dispersing ones, and simultaneously the electro-kinetic potential increases. (R. V. J.)

650

COLLOIDAL ZIRCONYL RADIOPHOSPHATE. S. W. Mayer and M. E. Morton (V. A. Hospital, Long Beach, Calif., and Univ. of California School of Medicine, Los Angeles). *Nucleonics* 13, No. 11, 98(1955) Nov.

The method of preparing precipitated colloidal zirconyl radiophosphate is outlined. (B.J.H.)

651

THE EFFECT OF LIGHT ON CERIC-CEROUS DOSIMETRY. S. W. Nicksic and J. R. Wright (California Research Corp., Richmond). *Nucleonics* 13, No. 11, 104-6(1955) Nov.

The effect of light on chemical dosimetry methods has been studied. Data on ceric ion concentration in ceric sulfate solutions after exposure to light have been tabulated. Data are also given on several Co^{60} sources monitored by chemical dosimetry. (B.J.H.)

652

ON CONJUGATED RADIATION CHEMISTRY REACTIONS IN AQUEOUS SOLUTIONS. M. A. Proskurnin, V. D. Orekhov, and E. V. Barelko. (Karpov Physico-Chemical Research Inst.). *Doklady Akad. Nauk S.S.S.R.* 103, 651-3 (1955) Aug. 1. (In Russian)

653

NUCLEAR AND RADIOCHEMISTRY. Gerhart Friedlander and Joseph W. Kennedy. New York, John Wiley and Sons, Inc., 1949. 468p. London, Chapman and Hall, Ltd.

A revised version of *Introduction to Radiochemistry* by the same authors is presented. New chapters are included on applications of nuclear energy and nature of cosmic radiation. (C.W.H.)

Refer also to abstracts 646 and 647.

RADIATION EFFECTS

654 NYO-3313

Yale Univ., New Haven. School of Engineering. POLYMERIZATION OF ETHYLENE INITIATED BY GAMMA RADIATION (thesis). James C. Hayward, Jr. June 1955. 277p. Contract AT(30-1)-1173.

Initial rates of the polymerization of ethylene initiated by γ radiation have been obtained between 0.1 and 60% per day at temperatures between 80 and 460°F, pressures between $\frac{1}{2}$ and 21 atm, and a radiation intensity of the order of 100,000 r/hr. The initial rates correspond to ion-pair yields between 5 and 2,500 and to G values between 20 and 10,000. The product was generally a liquid; however, a white waxy solid was obtained at room temperature and the higher pressures. The reaction is homogeneous and is strongly inhibited by a trace concentration of oxygen.

Furthermore, the effect of a saturation electric field on the rate of polymerization at 80°F and 2 atm is small, if not completely negligible. A simplified version of a free-radical polymerization mechanism is presented, according to which the ion-neutralization energy is ineffective in the initiation of ethylene polymerization and, furthermore, the chain-transfer process by which the liquid product is formed at elevated temperatures is suppressed by an increase in pressure. The initial radiation yields and the nature of the products obtained are generally consistent with the type of mechanism postulated. (auth)

655

EFFECT OF PROTON IRRADIATION UPON THE RATE OF SOLUTION OF Fe_2O_3 IN HYDROCHLORIC ACID. M. Simnad and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). *J. Chem. Phys.* 23, 1961-2(1955) Oct.

The rate of solution of Fe_2O_3 in HCl is significantly increased by proton irradiation. This effect upon the chemical properties of Fe_2O_3 has been ascribed to the production of lattice defects in the crystals. (C.W.H.)

656

STUDIES ON THE MECHANISM OF PHYTOHORMONE DAMAGE BY IONIZING RADIATION. I. THE RADIOSENSITIVITY OF IDOLEACETIC ACID. Solon A. Gordon and Robert P. Weber (Argonne National Lab., Lemont, Ill.). *Plant Physiol.* 30, 200-10(1955) May.

The in vitro sensitivity of indoleacetic acid (IAA) to x and γ radiation has been re-examined by a kinetic approach. No unusual lability of the auxin was observed on varying the auxin concentration or purity, oxygen concentration, H^+ concentration, radiation energy, dose rate, or method of assay. Ionic yields were near unity. Acid auxin extracted from the plant exhibits an intrinsic radiosensitivity not significantly higher than synthetic IAA. The effects of several cosolutes and plant extracts on IAA destruction were examined to determine the relative radical affinity of the auxin. The above observations indicate that an explanation other than direct auxin photolysis probably accounts for the lowering of auxin levels in plants exposed to low doses of ionizing radiation. An approximation is described for determining initial ionic yields where changes in solute concentration are nonlinear with respect to radiation dose. (auth)

Refer also to abstract 518.

RARE EARTHS AND RARE-EARTH COMPOUNDS

657

ON TRIPLE SYSTEM OF CERUM-CALCIUM-CHLORINE. G. L. Zverev. *Doklady Akad. Nauk S.S.S.R.* 104, 242-5(1955) Sept. 11. (In Russian)

Tables and a fusibility diagram of the Ce-Ca-Cl system are given. The constructed Ca-CeCl₃ phase diagram produces important data on compounds, smelting temperatures, and crystallization processes of products in the calcio-thermal reduction of CeCl₃. (R.V.J.)

658

SOLUBILITY OF HYDROXIDES IN RARE EARTHS. I. M. Korenman. (Gor'kiĭ State Univ.). *Zhur. Obshchei Khim.* 25, 1859-61(1955) Sept. (In Russian)

659

PHASE STUDIES OF EUROPIUM OXIDES. G. Brauer, R. Muller, and K. H. Zapp. *Z. anorg. u. allgem. Chem.* 280, 40-50(1955) Aug. (In German)

Refer also to abstracts 552 and 625.

SEPARATION PROCEDURES

660 ACCO-1

American Cyanamid Co. Atomic Energy Div., Watertown, Mass.

PROGRESS REPORT FOR JANUARY 16, 1951-MARCH 15, 1951. Decl. Sept. 23, 1955. 20p. Contract AT(49-1)-533.

Results obtained from analysis of U ore samples from Grants, New Mexico, Marysville, Utah, Hite, Utah, a fluorite deposit in Utah, and Rand ores are presented. Results obtained with anion exchange resins in pulp, and systematic studies with anion exchange resins are also reported. Application of the lyometallurgical process to several ores and the use of an activated alumina column for purification of pregnant solvent solutions before precipitation are mentioned. Analytical developments pertaining to phosphate, boron, and aluminum analysis are reported. (auth)

661 ACCO-5

American Cyanamid Co. Atomic Energy Div., Watertown, Mass.

LEACHING AND PRECIPITATION TESTS ON GRANTS ORES. Charles S. Abrams and D'Arcy R. George. Sept. 10, 1951. Changed from OFFICIAL USE ONLY Sept. 23, 1955. 24p. Contract AT(49-1)-533.

Leaching tests were run on two samples from the Grants area in New Mexico. Uranium extractions were obtained by leaching with solutions containing Na_2CO_3 and NaHCO_3 . The effects of fine grinding, long leaching periods, addition of an oxidant, and temperature of solution were investigated. Cyclic tests were completed using caustic precipitation of the leach liquor. (G.S.)

662 ACCO-33

American Cyanamid Co. Atomic Energy Div. Raw Materials Lab., Winchester, Mass.

ADDITIONAL EXTRACTION AND ION EXCHANGE STUDIES OF TEMPLE MOUNTAIN DISTRICT ORES. J. Q. Jones and H. I. Viklund. July 30, 1954. Decl. Sept. 23, 1955. 31p. Contract AT(49-1)-533.

Uranium extraction of 95% has been obtained from samples of Temple Mountain ore by a cyclic test procedure in which the new feed was not roasted. This procedure involved acid leaching the ore, flotation and roasting of the carbonaceous material, and acid leaching the roaster calcine. A total of 100 lb of H_2SO_4 per ton of ore and no oxidant was required for leaching. Treatment of the pregnant U liquor in a three column ion exchange system resulted in a recovery of 99.7% of the U from the solution. (auth)

663 ACCO-38

American Cyanamid Co. Atomic Energy Div., Raw Materials Development Lab., Winchester, Mass.

PROGRESS REPORT ON THE FLOTATION OF URANIUM BEARING MINERALS FROM LAKE ATHABASKA ORE, SAMPLE 43-1. J. B. Breymann, III, W. D. Charles, and P. N. Thomas. Oct. 12, 1953. Decl. Sept. 23, 1955. 26p. Contract AT(49-1)-533.

The flotation of uranium bearing minerals from Lake Athabaska Ore was accomplished by using American Cyanamid Company's 800-series reagents or octylorthophosphoric acid as collectors in an acid circuit. The optimum results thus far obtained on a deslimed pulp were an 86.7% U_3O_8 recovery in a weight ratio of concentration of 2.5 to 1.0 and on an undeslimed pulp were 77.4% U_3O_8 recovery in a 3.2 to 1.0 ratio of concentration. Both results were obtained with octylorthophosphoric acid. (auth)

664 ACCO-50

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

ION EXCHANGE OF GRANTS ACID LEACH LIQUORS. Dean F. Thorpe, Norman N. Schiff, F. Pickwick, Jr., J. W. Cole, and James T. Lynch. July 30, 1954. Decl. Sept. 23, 1955. 53p. Contract AT(49-1)-533.

The test work undertaken to evaluate the column ion exchange process for extraction of U from Grants acid leach liquors is summarized. The investigation included the preparation of ion exchange feed solutions, single column ion exchange tests run to determine the resin loadings expected at various retention times, and preliminary cyclic ion tests. (J.E.D.)

665 ACCO-51

American Cyanamid Co. Atomic Energy Div. Raw Materials Lab., Winchester, Mass.

VANADIUM SALT ROASTING STUDIES. Alan Stanley. July 21, 1954. Decl. Sept. 23, 1955. 14p. Contract AT(49-1)-533.

The test work showed that three variables were important in obtaining good vanadium extractions. These variables in the order of their importance were: 1) the concentration of salt, 2) the roasting time, and 3) the temperature. There was also evidence of first and second order interactions between the three variables. In general, eight percent salt, 850°C, and 45 minutes roasting time are the optimum conditions for vanadium extraction by salt roasting methods. (auth)

666 ACCO-57

American Cyanamid Co. Atomic Energy Div. Raw Materials Lab., Winchester, Mass.

PILOT PLANT TESTS ON ANACONDA FROM THE GRANTS DISTRICT, GRANTS, NEW MEXICO. R. F. Hollis, C. S. Abrams, C. K. McArthur, T. F. Izzo, and H. Wilson. July 22, 1954. Decl. Sept. 23, 1955. 22p. Contract AT(49-1)-533.

A series of pilot plant runs were made on the Jackpile ore, Jackpile mixed blend, Jackpile-Poison Valley blend, and Jackpile-Arrowhead blend. Each ore was leached with sulfuric acid; after discarding sands with a cyclone and 3 drag classifiers, the pulp was passed through the R. I. P. section to adsorb uranium. The saturated resin was eluted with a 0.9M NH_4NO_3 solution adjusted to a pH of 1.2 with sulfuric acid. The eluate was precipitated with NH_3 or MgO , with a final precipitate assaying over 70% U_3O_8 obtained for each ore or blend. An overall theoretical recovery, calculated from the assays of products, was over 93% for all the ores, and a recovery of over 91% was obtained with the Jackpile-Arrowhead blend. (auth)

667 ACCO-58

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

FIELD WORK PERFORMED AT MONTICELLO, UTAH, INCLUDING STOCKPILE AMENABILITY AND ION EX-

CHANGE. Harry D. Moulton, Jr. July 20, 1954. Decl. Sept. 23, 1955. 43p. Contract AT(49-1)-533.

Bench scale leaching, pilot plant testing, and ion exchange investigations were made on samples of ore stockpiled at Monticello, Utah. Some testing of carbonate leach tailings was also completed. All ores were leached with varying amounts of sulfuric acid at various densities, temperatures, grinds, and times. Uranium extractions ranging from 92 to 98% were obtained on all ores by acid leaching. Liquors from the ores were found amenable to ion exchange with some reservations. (auth)

668 AECD-3694

Mound Lab., Miamisburg, Ohio.

REPORT FOR GENERAL RESEARCH [FOR] SEPTEMBER 18 TO DECEMBER 11, 1950. (Radium Volume). Jan. 15, 1951. Decl. with deletions Aug. 26, 1955. 65p. Project 70A-D, 71A. Contract AT-33-1-GEN-53.

Progress is reported in the development of a process for the separation and subsequent purification of radium from pitchblende residue. After a preliminary extraction of about 85% of the lead and 40% of the silica with a 40% sodium hydroxide solution, the residue is treated with a solution containing both sodium hydroxide and sodium carbonate to obtain additional lead removal and partial conversion of the radium and barium sulfates to carbonates. After leaching out the soluble carbonates, the residue containing unconverted sulfates is treated with a sodium carbonate solution at 170° under pressure. A study of the amount and concentration of sodium carbonate required to obtain a satisfactory conversion of the sulfates has shown that the total sodium carbonate may be reduced by 40% and that smaller volumes of solution may be employed without serious decrease in the efficiency of the conversion. In order to make calculations on the number of steps and tank sizes for the radium-barium separation by fractional precipitation, equations have been developed to calculate this information from the theoretical separation factors determined experimentally. Three methods for carrying out the radium-barium separation by fractional precipitation of chromates have been studied and the separation factors determined. The methods differ in the reagent and temperature employed for the neutralization of the nitric acid solution of the chromates. The separation factor improves with decrease in temperature, and a marked improvement has been found by replacing urea which requires boiling temperatures for hydrolysis with potassium cyanate which hydrolyzes at much lower temperatures. Radium of over 40% purity was obtained by the chromate fractionation methods. Data are included on the effects of pH and temperature on the ion exchange separation of Ba and Ra. (auth)

669 BMI-264

Battelle Memorial Inst., Columbus, Ohio.

NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report [for October 15, 1952 to January 15, 1953]. R. A. Ewing, M. Pobereskin, R. B. Kimball, and A. E. Bearse. Jan. 15, 1953. Decl. Oct. 17, 1955. 32p. Contract AT(49-1)-635.

Dissolution of carnotite in several readily liquefiable gases, including ammonia, sulfur dioxide, chlorine, and nitrogen dioxide, was found to be negligible, even in the presence of uranium complexing agents. No low-boiling liquids have been found which will dissolve carnotite directly. Treatment with various sulfur chlorides will

convert carnotite to a form soluble in water or in certain organic solvents. Also carnotite can be readily dissolved in HCl-acidified ethanol, methanol, or acetone. Amenable tests on nine western ores with HCl-methanol solvent indicated that U extractions greater than 90% could be obtained if sufficient acid was used to insure some free acidity in the pregnant liquor. Temple Mountain and Sinbad-Muddy River ores were exceptions to this, U extractions being only about 50 to 60%. Vanadium extractions were invariably lower than U extractions. Chemical analyses are presented for nine western ores. (auth)

670 BMI-265

Battelle Memorial Inst., Columbus, Ohio.

NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report [for January 15, 1953 to April 15, 1953]. R. A. Ewing, M. Pobereskin, R. B. Kimball, and A. E. Bearse. Apr. 15, 1953. Decl. Oct. 17, 1955. 32p. Contract AT-(49-1)-635.

Continuing studies of HCl-methanol leaching of Western ores indicate that U extractions of 98 to 99%, and V extractions of up to 80% are attainable by baking the ore with concentrated HCl before leaching. A concentrated HCl bake appears to be more effective than a concentrated H₂SO₄ bake. Higher thickening and filtration rates were obtained with HCl-methanol slurries than with either aqueous HCl or H₂SO₄ slurries. Adsorption of U from HCl-methanol solutions has been successfully accomplished with IRA-400 anion-exchange resin. The observed distribution coefficient was in excess of 1000. Recovery of the V by distillation is indicated. U and V have been volatilized from Western ores by chlorination, either with Cl₂ at about 1000°C., or by CCl₄ at 600 to 700°C. Removals of up to 95 to 98% have been attained. (auth)

671 BMI-271

Battelle Memorial Inst., Columbus, Ohio.

NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report [for April 15 to July 15, 1953]. R. A. Ewing, M. Pobereskin, R. B. Kimball, and A. E. Bearse. July 15, 1953. Decl. Oct. 17, 1955. 34p. Contract AT-(49-1)-635.

Studies of HCl-methanol leaching of Western ores have been continued, primarily on Temple Mountain ores. A U extraction of 98% and a V extraction of 94% were obtained on one sample of Temple Mountain ore, when leaching was preceded by a bake with aqueous HCl + fluoride. Maximum U extraction on this Temple Mountain sample with a sulfuric acid bake-methanol leach has been 92%. U extractions have been somewhat less on the lower grade Temple Mountain samples received from current mill operations of the Vitro Chemical Company. Maximum U extraction on mill calcines by a methanol leach has been 90%, obtained by an HCl bake to which 40 lbs. KClO₃/ton was added. In the absence of an oxidizing agent, U extraction was only 50 to 70%. Satisfactory U extractions on Temple Mountain ore by high-temperature chlorination in a fluidized bed have been attained only when fairly large excesses of chlorinating agent were employed. Maximum U extractions have not exceeded those attainable by leaching treatments. (For preceding period see BMI-265.) (auth)

672 BMI-273

Battelle Memorial Inst., Columbus, Ohio.

NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report [for July 15 to October

20, 1953]. R. A. Ewing, M. Pobereskin, R. B. Kimball, and A. E. Bearse. Oct. 20, 1953. Decl. Oct. 17, 1955. 24p. Contract AT-(49-1)-635.

Studies have been continued on nonaqueous extractive methods for recovering U and V from Western ores, principally on an asphaltic ore from Temple Mountain, assaying 0.26% U. HCl continues to be the preferred acid for the methanol leach process, although several possible methods of substituting H_2SO_4 for HCl are being investigated. U extractions from Temple Mountain ore of up to 97% have been obtained by the HCl bake-methanol leach process. U volatilizations in the 90 to 94% range have been obtained by chlorinating either roasted Temple Mountain ore with CCl_4 at 600°C., or raw ore with Cl_2 at 1000°C. Roasted ore can also be successfully chlorinated with Cl_2 if C is added. (auth)

673 BMI-276

Battelle Memorial Inst., Columbus, Ohio.
NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report [for October 20, 1953 to January 20, 1954]. R. A. Ewing, R. B. Kimball, S. J. Kiehl, Jr. and A. E. Bearse. Jan. 20, 1954. Decl. Oct. 17, 1955. 26p. Contract AT-(49-1)-635.

Settling rates of several hundred feet per hour and very high extractions of U have been obtained with Western ores in HCl-acetone systems under certain conditions. Moisture content appears to be the most critical factor controlling the particle agglomeration associated with these extremely rapid settling rates. No sliming problem exists in such systems, and ore as fine as minus 325 mesh can be satisfactorily treated. Uranium extraction is not adversely affected by the conditions necessary for rapid settling. Presence of excess HCl in leach liquors does not appear essential for high uranium extractions. At an HCl input of 70 lbs. of 100% HCl/ton, which gave zero free acid in the acetone leach liquor, U extractions of 89% from Temple Mountain ore and 95% from normal carnotite were obtained. Volatilization of U by a sintering type of roast with carbon plus NaCl at 1000°C. was negligible, although some volatilization of V was obtained. (auth)

674 BMI-277

Battelle Memorial Inst., Columbus, Ohio.
NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report for January 20 to April 20, 1954. R. A. Ewing, R. B. Kimball, S. J. Kiehl, Jr., and A. E. Bearse. Apr. 20, 1954. Decl. Oct. 17, 1955. 36p. Contract AT-(49-1)-635.

H_2SO_4 can be partially substituted for HCl in the HCl-acetone process for the extraction of U from Western ores, the extent of substitution being dependent on the $CaCO_3$ content of the ore. If equivalency with the limestone is not exceeded, U extraction and settling rates in acetone are virtually the same as with HCl alone. Raw carbonaceous-type ores may be satisfactorily processed, with minor process modifications. U extractions of 92 to 94% were obtained by grinding Temple Mountain ore to minus 200 mesh before acid curing. Addition of 10 lbs of $KClO_3$ per ton to the acid cure of raw minus 50-mesh Steen ore produced a U extraction of 95% on acetone leaching. The U may be recovered as a primary precipitate containing 2 to 3% U by neutralization of the acetone-leach liquors with anhydrous NH_3 . After removal of the bulk of the chlorides by washing or ignition, and removal of the V by a ferric vanadate

precipitation, a U concentrate containing 60% U_3O_8 or over may be produced. (auth)

675 BMI-278

Battelle Memorial Inst., Columbus, Ohio.
NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Progress Report [for April 20 to October 20, 1954. R. A. Ewing, D. D. Foley, A. E. Bearse, and R. B. Filbert, Jr. Oct. 20, 1954. Decl. Oct. 17, 1955. 50p. Contract AT-(49-1)-635.

A pilot plant with a capacity of about 125 lb of dry ore per hr has been constructed to determine the feasibility of the hydrochloric acid-acetone extraction process for recovery of U from Western ores and to obtain operating data on this process. The various units of the pilot plant have been given preliminary operating tests. The very rapid phase separation, which characterizes the process in the laboratory, has been realized in the pilot-plant extraction studies. A process flowsheet is presented. Further laboratory work on the acetone extraction process is described. U extractions of 95 to 98% have been obtained from minus 12-mesh Stockpile 29 ore with 87.5 to 105 lbs. HCl/ton, and also with partial substitution of sulfuric acid for hydrochloric acid. U extractions from the higher lime Stockpile 6 ore have run slightly lower, 91 to 93%. Calcination at 400 to 500°C of the primary precipitate obtained by neutralization of acetone leach liquors with ammonia results in calcines suitable for soda ash-sawdust fusion. Water-leached residues from fusion tests have contained from 9 to 15% U, 0.3 to 0.5% V, and from 40 to 50% iron. (For preceding period see BMI-277.) (auth)

676 DOW-62

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. Progress Report for September 1951. Research Dept. R. H. Bailes. Sept. 28, 1951. Decl. Sept. 29, 1955. 60p. Contract AT-30-1-GEN-236.

Data on extraction of U from Company A (30% P_2O_5) H_2PO_4 by monooctyl, mono-(2-ethylhexyl), and monoiso-octyl acid phosphates indicate the effect of branched-chain position. Extractions by dioctyl acid pyrophosphate are the highest yet found. Data on the leaching of U from superphosphate, triple superphosphate, and monoammonium phosphate with alkyl phosphoric acids under various conditions of agitation, temperature, and original dryness are tabulated. The effect of fluoride on U(IV) extraction by octyl phosphoric acid (OPA) and removal of U from OPA with numerous reagents, special attention being paid to HCl, are reported. The effect of strong oxidation on improving the ion-exchange adsorption of U from Company K (24% P_2O_5) acid is shown. Ion-exchange equilibrium isotherms of U from Company M (14% P_2O_5) acid containing nitrate are given and two experimental resins are evaluated. Additional data on the ammonia neutralization and Na-amalgam reduction processes are given. (G.Y.)

677 DOW-63

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. Progress Report for October 1951. Research Dept. R. H. Bailes. Nov. 8, 1951. Decl. Sept. 29, 1955. 83p. Contract AT-30-1-GEN-236.

Effects of successive re-use of dioctyl pyrophosphate on its extraction of U_3O_8 from Company A phosphoric acid; variations in the distribution coefficient of U between

Company A acid and octyl phosphoric acid in kerosene with degree of reduction and volume ratio; recoveries obtained in mixer-settler continuous extraction; and settling rates in Company A acid of octyl, amyl, and butyl phosphoric acids in kerosene and aromaticoil 1049 are tabulated and graphed. The amount of HF needed in the HF process for recovery of U from the extractant and removal of excess HF from the barren extract are considered. Re-use of reagents, possible oxidation agents, and recovery of U from the HCl on Dowex 1 resin in the concentrated HCl extraction process are discussed; infrared absorption spectra of monoisooctyl and mono-di-isooctyl acid phosphates in CCl_4 are shown. The possibility of extracting the octyl phosphoric acid by methanol, leaving the U in the kerosene, has been studied; distribution coefficients between the phases, recovery of U from the kerosene phase, and a ternary CH_3OH -octyl phosphoric acid-kerosene solubility diagram are given. Recovery of U with concentrated phosphoric acid and miscellaneous reagents also is discussed. Additional work on the leaching of various phosphatic materials with alkyl acid phosphates is reported. Effects of concentration of phosphoric acid, various oxidizing agents, addition of Ca ion and various reducing and complexing agents on the recovery of U from Company E phosphoric acid by NH_3 neutralization are discussed. Evaluation of several experimental ion-exchange resins has continued. (auth)

678 DOW-67

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. Progress Report for December 1951. Research Dept. R. H. Bailes. Jan. 10, 1952. Decl. Sept. 29, 1955. 58p. Contract AT-30-1-GEN-236.

The use of commercial octyl phosphoric acid in kerosene diluent for the recovery of U from industrial phosphoric acid by liquid-liquid extraction is described. Experiments on the chemistry and mechanics of the extraction process have been performed. Processes for the recovery of the U from the organic extract are being developed. The study of a process for the recovery of U from two industrial phosphoric acids by precipitation with ammonia has been continued. (auth)

679 DOW-68

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM MISCELLANEOUS MATERIALS. Progress Report for January 1952. Research Dept. R. H. Bailes. Feb. 4, 1952. Decl. Sept. 29, 1955. 25p. Contract AT-30-1-GEN-236.

The recovery of U and V from Lukachukai ore by means of organic phosphates is being investigated. Details of leaching with either aqueous acid or organic phosphate plus diluent are reported. Further work on the chromatographic elution of U from Dowex 1 is described. The effect of using nitrate in place of chloride as the eluant is reported. (auth)

680 DOW-69

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. Progress Report for January 1952. Research Dept. R. H. Bailes. Feb. 12, 1952. Decl. Sept. 29, 1955. 76p. Contract AT-30-1-GEN-236.

The use of commercial octyl phosphoric acid in kerosene diluent for the recovery of uranium from industrial phosphoric acid by liquid-liquid extraction is described. Ex-

periments on the chemistry and mechanics of the extraction process have been performed. Processes for the recovery of the uranium from the organic extract are being developed. The study of a process for the recovery of uranium from two industrial phosphoric acids by precipitation with ammonia has been continued. (auth)

681 DOW-72

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] FEBRUARY 1952. Research Dept. R. H. Bailes. Mar. 3, 1952. Decl. Sept. 29, 1955. 59p. Contract AT-30-1-GEN-236.

The use of commercial octyl phosphoric acid in kerosene diluent for the recovery of U from industrial phosphoric acid by liquid-liquid extraction is described. Experiments on the chemistry and mechanics of the extraction process have been performed. Processes for the recovery of the U from the organic extract are described. The recovery of U and V from Lukachukai ore by means of organic phosphates is being investigated. Details of leaching with either aqueous acid or organic phosphate plus diluent are reported. (For preceding period see DOW-68.) (auth)

682 DOW-74

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] MARCH 1952. Research Dept. R. H. Bailes. Apr. 3, 1952. Decl. Sept. 29, 1955. 96p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in kerosene diluent for the recovery of uranium from industrial phosphoric acid and solid phosphatic materials by liquid-liquid extraction is described. Experiments on the chemistry and mechanics of the extraction process have been performed. Processes for the recovery of the uranium from the organic extract are described. The recovery of uranium and vanadium from Lukachukai ore by means of organic phosphates is being investigated. Details of leaching with either aqueous acid or organic phosphate plus diluent are reported. (auth)

683 DOW-79

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT FOR MAY 1952. Research Dept. R. H. Bailes. June 11, 1952. Decl. Sept. 29, 1955. 74p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in kerosene diluent for the recovery of uranium from industrial phosphoric acid and a nitric-sulfuric-phosphate rock slurry by liquid-liquid extraction is described. Studies of the chemistry and mechanics of the extraction process and the recovery of uranium from the extractant are reported. A preliminary investigation of the recovery of uranium and vanadium from Lukachukai ore by solvent extraction and by ion exchange is described. (auth)

684 DOW-80

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JUNE 1952. Research Dept. R. H. Bailes. July 7, 1952. Decl. Sept. 29, 1955. 84p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in kerosene diluent for the recovery of U from industrial phosphoric acid by liquid-liquid extraction is described. Studies of the chemistry and mechanics of the extraction process and the recovery of U from the extractant are reported. A preliminary investigation of the

recovery of U and V from Lukachukai ore by solvent extraction and by ion exchange is described. (auth)

685 DOW-83

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JULY 1952. Research Dept.
R. H. Bailes. Aug. 6, 1952. Decl. Sept. 29, 1955. 96p.
Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in kerosene diluent for the recovery of U from industrial phosphoric acid by liquid-liquid extraction is described. Studies of the chemistry and mechanics of the extraction process and the recovery of U from the extractant are reported. A preliminary investigation of the recovery of U and V from Lukachukai ore by solvent extraction is described. (auth)

686 DOW-84

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] AUGUST 1952. Research Dept. R. H. Bailes. Sept. 12, 1952. Decl. Sept. 29, 1955. 70p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in kerosene diluent for the recovery of uranium from industrial phosphoric acid by liquid-liquid extraction is described. Studies of the chemistry and mechanics of the extraction process, and the recovery of uranium from the extractant are reported. A preliminary investigation of the recovery of uranium and vanadium from Lukachukai ore by solvent extraction is described. (auth)

687 DOW-85

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] SEPTEMBER 1952. Research Dept. R. H. Bailes. Oct. 3, 1952. Decl. Sept. 29, 1955. 84p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in kerosene diluent for the recovery of U from industrial phosphoric acid by liquid-liquid extraction is described. Studies of the chemistry and mechanics of the extraction process and the recovery of U from the extractant are reported. A preliminary investigation of the recovery of U and V from Lukachukai ore by solvent extraction is described. (For preceding period see Dow-84.) (auth)

688 DOW-86

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM AND OTHER VALUES FROM FLORIDA LEACH ZONE MATERIAL. Progress Report for October 1952. Research Dept. R. H. Bailes. Oct. 31, 1952. Decl. Sept. 29, 1955. 24p. Contract AT-30-1-GEN-236.

A preliminary study of the recovery of U and other values from Florida leach zone material by leaching with hydrochloric acid, caustic carbonates, and organic phosphate and pyrophosphate solutions is presented. (For preceding period see DOW-85.) (auth)

689 DOW-87

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] OCTOBER 1952. Research Dept. R. H. Bailes. Nov. 3, 1952. Decl. Sept. 29, 1955. 63p. Contract AT-30-1-GEN-236.

A number of impure "mixed" higher alcohols have been tested as replacements for capryl alcohol in the preparation of octyl pyrophosphoric acid (OPPA). In recovery of U

from phosphoric acid it has been found that the presence of unprecipitated U from the first cycle of an OPPA extract with HF does not decrease recovery in the second cycle. Recoveries of U as high as 75% to 80% appear possible from superphosphate without dissolving the product by leaching with OPPA in kerosene under proper conditions. Several attempts were made to achieve a separation of OPPA by adsorption on Dowex 1 and chromatographic elution with 0.2N NaCl. Direct leaching tests on carnotite ores with organic phosphoric acids in various solvents are reported. (G.Y.)

690 DOW-88

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM AND OTHER VALUES FROM FLORIDA LEACH ZONE MATERIAL. Progress Report for November, 1952. Research Dept. R. H. Bailes. Dec. 4, 1952. Decl. Sept. 29, 1955. 30p. Contract AT-30-1-GEN-236.

A preliminary study is presented of the recovery of U from Florida leach zone material by leaching with various solutions and extraction of U from the leach solutions with organic solvents. (For preceding period see DOW-87.) (auth)

691 DOW-93

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM AND VANADIUM FROM CARNOTITE ORES BY SOLVENT EXTRACTION. Progress Report for January 1953. Research Dept. R. H. Bailes. Jan. 30, 1953. Decl. Sept. 29, 1955. 47p. Contract AT-30-1-GEN-236.

An investigation of the recovery of U and V from acid slurries of Lukachukai ore by solvent extraction with dioctyl phosphoric acid is reported. (auth)

692 DOW-94

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] FEBRUARY 1953. Research Dept. R. H. Bailes. Mar. 10, 1953. Decl. Sept. 29, 1955. 96p. Contract AT-30-1-GEN-236.

An investigation of the recovery of uranium from nitric acid leaches of Florida leach zone material by solvent extraction with octyl pyrophosphoric acid and tributyl phosphate is reported. A study of caustic leaching of the ore and recovery of uranium by precipitation methods is presented. An investigation of the recovery of uranium and vanadium from acid slurries of Lukachukai ore by solvent extraction with dioctyl phosphoric acid is reported. (auth)

693 DOW-95

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] MARCH 1953. Research Dept. R. H. Bailes. Apr. 1, 1953. Decl. Sept. 29, 1955. 79p. Contract AT-30-1-GEN-236.

The results of investigations of the recovery of uranium and other values from carnotite ores, Florida leach-zone material, normal and triple superphosphates and a calcium sulfate residue by means of solvent extraction with organic phosphates and pyrophosphates and by other methods are presented. (auth)

694 DOW-96

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] APRIL 1953. Research Dept. R. H. Bailes. May 1, 1953. Decl. Sept. 29, 1955. 73p. Contract AT-30-1-GEN-236.

The results of investigations of the recovery of U, Al,

and V from carnotite ores and phosphatic materials by means of solvent extraction with organic phosphates and pyrophosphates, and of the recovery of U from a Ca sulfate residue by acid leaching are presented. (For previous report in series see DOW-95.) (auth)

695 DOW-97

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] MAY 1953. Research Dept.
R. H. Bailes. June 1, 1953. Decl. Sept. 29, 1955. 77p.
Contract AT-30-1-GEN-236.

The results of investigations of the recovery of U and V from leach solutions of carnotite ores and of U from leach solutions of Florida leach zone material by solvent extraction with organic phosphates and pyrophosphates, of the recovery of U and other values from leach zone material by caustic leaching, and of the recovery of U from a calcium sulfate residue of fluorite ore by acid leaching are presented. (For preceding period see DOW-96.) (auth)

696 DOW-99

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JUNE 1953. Research Dept.
R. H. Bailes. July 1, 1953. Decl. Sept. 29, 1955. 47p.
Contract AT-30-1-GEN-236.

Results of investigations of the recovery of U and V from leach solutions of carnotite ores and of U from leach solutions of Florida leach-zone material by solvent extraction with organic phosphates and pyrophosphates are presented. (auth)

697 DOW-100

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JULY 1953. Research Dept.
R. H. Bailes. Aug. 1, 1953. Decl. Sept. 29, 1955. 67p.
Contract AT-30-1-GEN-236.

The results of investigations of the recovery of U and V from leach solutions of carnotite ores and of the recovery of uranium from shales and from acid leach solutions of Florida leach zone material by solvent extraction with organic phosphates and pyrophosphates are presented. Studies of the recovery of U and other values from leach zone material by caustic leaching and the recovery of U from a calcium sulfate residue of fluorite ore by acid leaching are reported. (For preceding period see DOW-99.) (auth)

698 DOW-101

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] AUGUST 1953. Research Dept.
R. H. Bailes. Sept. 1, 1953. Decl. Sept. 29, 1955. 79p.
Contract AT-30-1-GEN-236.

The results of investigations of the recovery of uranium and vanadium from leach solutions of carnotite ores and of the recovery of uranium from shales and from acid leach solutions of Florida leach zone material by solvent extraction with organic phosphates and pyrophosphates are presented. Studies of the recovery of uranium and other values from leach zone material by caustic leaching and of the recovery of uranium during the manufacture of phosphoric acid are reported. (auth)

699 DOW-103

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] SEPTEMBER 1953. Research Dept.
R. H. Bailes. Oct. 1, 1953. Decl. Sept. 29, 1955. 78p. Contract AT-30-1-GEN-236.

The results of investigations of the recovery of uranium and vanadium from leach solutions of carnotite ores and of the recovery of uranium from shales and from acid leach solutions of Florida leach zone material by solvent extraction with organic phosphates and pyrophosphates are presented. Studies of the recovery of uranium and other values from leach zone material by caustic leaching and of the recovery of uranium during the manufacture of phosphoric acid are reported. (auth)

700 DOW-104

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] OCTOBER 1953. Research Dept.
R. H. Bailes. Nov. 2, 1953. Decl. Sept. 29, 1955. 69p. Contract AT-30-1-GEN-236.

Results of investigations of the recovery of U and V from leach solutions of carnotite ores and of the recovery of U from acid leach solutions of Florida leached zone material by solvent extraction with organic phosphates and pyrophosphates are presented. Studies of the recovery of U and other values from leached zone material by caustic leaching and of the recovery of U during the manufacture of H_3PO_4 are reported. (auth)

701 DOW-105

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] NOVEMBER 1953. Research Dept.
R. H. Bailes. Dec. 1, 1953. Decl. Sept. 29, 1955. 56p. Contract AT-30-1-GEN-236.

The results of investigations of the recovery of U and V from leach solutions of carnotite ores and of the recovery of U from acid leach solutions of Florida leached zone material by solvent extraction with organic phosphates and pyrophosphates are presented. Studies of the recovery of U and other values from leached zone material by caustic leaching and of the recovery of U during the manufacture of phosphoric acid are reported. (For preceding period see DOW-104.) (auth)

702 DOW-107

Dow Chemical Co. Great Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM PHOSPHORIC ACID SOLUTIONS: FLUORIDE PROCESS. Summary
Status Report No. 2. R. H. Bailes. Dec. 8, 1949. Decl. Sept. 29, 1955. 19p. Contract AT-30-1-GEN-236.

A process is described for the recovery of U from commercial 30% H_3PO_4 based on the carrier precipitation of U with HF and limestone. The precipitate can be treated in one of three separate methods to recover HF for recycle and to produce a concentrate of U. Preliminary cost estimates are presented for two of the three methods both of which are based on a currently available feed stream of 500 tons of H_3PO_4 per day. The HF leach process will furnish U as a 55 to 65% concentrate at an estimated cost of \$25.00/lb. of U_3O_8 . When the precipitate is de-fluorinated, then calcined, and finally leached with dilute H_2SO_4 , the cost is estimated to be \$27.00/lb. of U_3O_8 obtained as a 10 to 20% concentrate. (auth)

703 DOW-108

Dow Chemical Co. Great Western Div., Pittsburg, Calif.
RECOVERY OF URANIUM FROM PHOSPHATE BY ION EXCHANGE. Summary Status Report No. 3. R. H. Bailes. Dec. 7, 1949. Decl. Sept. 29, 1955. 20p. Contract AT-30-1-GEN-236.

A process which will produce UF_4 of 95% purity from commercial 30% H_3PO_4 has been developed. This process

will recover 98% of the uranium in the feed acid. Based on a currently available feed stream of 500 tons of 30% H_3PO_4 per day, the manufacturing cost is estimated at \$5.17/lb U_3O_8 in an ion-exchange plant costing \$218,000. In addition to the U, this acid also contains a substantial amount of V. With the same ion-exchange plant, 91% of the V can be recovered as a 50% concentrate of V_2O_5 in the amount of 25 pounds V_2O_5 /lb. U_3O_8 at an additional cost of only \$0.11/lb V_2O_5 . The V recovery process now operating on this acid stream extracts only about 80% of the V present. Thus, the value of the additional 3 pounds of V_2O_5 /lb U_3O_8 made available by the ion-exchange process could properly be credited to the U_3O_8 raw material cost. With V_2O_5 at \$1.00/lb the net cost of U_3O_8 would then be only \$2.50/lb. It should be stated that these cost calculations have been based on an assumed resin life of only 500 cycles. If the resin life is of the order of 1000 or more cycles as currently available laboratory data indicates may be possible, the cost of U_3O_8 could be reduced from \$2.50 to about \$2.00/lb, and the V_2O_5 cost from \$0.11 to \$0.09/lb. (auth)

704 DOW-109

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] DECEMBER 1953. Research Dept. R. H. Bailes. Jan. 4, 1954. Decl. Sept. 29, 1955. 46p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from leach solutions of carnotite ores and of the recovery of uranium from acid leach solutions of Florida leached zone material by solvent extraction with organic phosphates are reported. (auth)

705 DOW-110

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JANUARY 1954. Research Dept. R. H. Bailes. Feb. 1, 1954. Decl. Sept. 29, 1955. 43p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from leach solutions of carnotite ores by solvent extraction with organic phosphates are reported. (auth)

706 DOW-113

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] FEBRUARY 1954. Research Dept. R. H. Bailes. Mar. 1, 1954. Decl. Sept. 29, 1954. 37p. Contract AT-30-1-GEN-236.

Studies of the recovery of U and V from leach solutions of carnotite ores by solvent extraction with organic phosphates and procedures for the preparation of extractants are reported. (For preceding period see DOW-110.) (J.E.D.)

707 DOW-114

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] MARCH 1954. Research Dept. R. H. Bailes. Apr. 1, 1954. Decl. Sept. 29, 1955. 36p. Contract AT-30-1-GEN-236.

Studies of the recovery of U and V from leach solutions of carnotite ores by solvent extraction with organic phosphates and of the recovery of U and other values from Florida leached zone material by caustic leaching are reported. (For preceding period see DOW-113.) (auth)

708 DOW-115

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] APRIL 1954. Research Dept.

R. H. Bailes. May 1, 1954. Decl. Sept. 29, 1955. 52p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from leach solutions of carnotite ores by solvent extraction with organic phosphates and of the recovery of uranium and other values from Florida leached zone material by caustic leaching are reported. (auth)

709 DOW-116

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] MAY 1954. Research Dept. R. H. Bailes. June 1, 1954. Decl. Sept. 29, 1955. 49p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from leach solutions of carnotite ores by solvent extraction with organic phosphates and of the recovery of uranium and other values from Florida leached zone material by caustic leaching are reported. (auth)

710 DOW-117

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JUNE 1954. Research Dept. R. H. Bailes. July 1, 1954. Decl. Sept. 29, 1955. 54p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from leach solutions of carnotite ores by solvent extraction with organic phosphates and of the recovery of uranium from leach solutions of Florida leached zone material and from a nitric acid slurry of phosphate rock by solvent extraction with organic phosphates and pyrophosphates are reported. (auth)

711 DOW-120

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JULY-AUGUST 1954. Research Dept. R. H. Bailes. Sept. 1, 1954. Decl. Sept. 29, 1955. 71p. Contract AT-30-1-GEN-236.

Studies of the recovery of U, V, Al, Mo, and Fe from leach solutions of plateau ores, and uranium from acid leaches of Florida leached zone ores by solvent extraction with organic phosphate solutions and of the recovery of U and other values from leached zone ores by caustic leaching and selective precipitation are presented. (auth)

712 DOW-122

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] SEPTEMBER-OCTOBER 1954. Research Dept. R. H. Bailes. Nov. 1, 1954. Decl. Sept. 29, 1955. 59p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from plateau ores by solvent extraction with organic phosphate solutions, and of the recovery of uranium and other values from Florida leached zone ores by caustic leaching and selective precipitation are presented. (auth)

713 DOW-125

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] NOVEMBER-DECEMBER 1954. Research Dept. R. H. Bailes. Jan. 1, 1955. Decl. Sept. 29, 1955. 46p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from plateau ores by solvent extraction with organic phosphate solutions and of the recovery of uranium and other values from Florida leached zone ores by caustic leaching and selective precipitation are presented. (auth)

714 DOW-127

Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JANUARY-FEBRUARY 1955.

Research Dept. R. H. Bailes. Mar. 1, 1955. Decl. Sept. 29, 1955. 72p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from plateau ores by solvent extraction with organic phosphate solutions and of the recovery of uranium and other values from Florida leached zone ores by caustic leaching and selective precipitation are presented. (auth)

715 DOW-129

Dow Chemical Co. Western Div., Pittsburg, Calif. PROGRESS REPORT [FOR] MARCH-APRIL 1955. Research Dept. R. H. Bailes. May 1, 1955. Decl. Sept. 29, 1955. 50p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium and vanadium from plateau ores by solvent extraction of aqueous leach liquors with organic phosphate solutions and by monaqueous leaching with organic leach solutions are presented. (auth)

716 DOW-132

Dow Chemical Co. Western Div., Pittsburg, Calif. PROGRESS REPORT [FOR] MAY-JUNE 1955. Research Dept. R. H. Bailes. July 1, 1955. Decl. Sept. 29, 1955. 23p. Contract AT-30-1-GEN-236.

Studies of the recovery of uranium from plateau ores by solvent extraction of aqueous leach liquors with organic phosphate solutions and by non-aqueous leaching with organic leach solutions are presented. (For preceding period see DOW-129.) (auth)

717 DOW-136

Dow Chemical Co. Western Div., Pittsburg, Calif. PROGRESS REPORT FOR SEPTEMBER-OCTOBER 1955. Research Dept. R. H. Bailes. Nov. 1, 1955. 37p. Contract AT-30-1-GEN-236.

Studies of the recovery of U from plateau ores by solvent extraction of aqueous leach liquors and slurries with organic phosphate solutions, and by non-aqueous leaching with organic leach solutions are presented. (For preceding period see DOW-134.) (auth)

718 ISC-549

Ames Lab., Ames, Iowa. DETERMINATION OF THE EQUILIBRIUM CONSTANT FOR THE EXCHANGE OF NITROGEN ISOTOPES BETWEEN AMMONIUM HYDROXIDE SOLUTION AND AMMONIUM ION ADSORBED ON DOWEX-50. F[rank] H[arold] Spedding, J[ack] E. Powell, and D. M. Provow. Nov. 29, 1954. Decl. Sept. 8, 1955. 8p. Contract W-7405-eng-82.

A method is derived for determining the equilibrium constant for the exchange of N^{15} and N^{14} isotopes in the reaction $N^{15}H_4OH_S + N^{14}H_4^+_R \rightleftharpoons N^{14}H_4OH_S + N^{15}H_4^+_R$, where S and R refer to solution and resin phases, respectively. K is defined as R_R/R_S , where R is the ratio of N^{15} to N^{14} . The value of K was determined to be 1.0025 ± 0.00002 . (M.P.G.)

719 NYO-5191

Mallinckrodt Chemical Works, St. Louis. COMMENTS ON PLANT 6 [ORE REFINERY] INVENTORY SAMPLING. F. L. Epelley. Aug. 1, 1946. Decl. Nov. 2, 1955. 8p.

Methods of sampling each step in the U ore refining process to determine the amount of U in each step is described. Recommendations are also made which if adopted will improve the technique of sampling thereby improving the monthly inventory of U in refining process. (B.J.H.)

720 ORNL-1047

Oak Ridge National Lab., Tenn. PRODUCTION OF FISSION PRODUCT IODINE 131. A. F. Rupp, E. E. Beauchamp, and J. R. Farmakes. Dec. 18, 1951. Decl. July 7, 1955. 26p. Contract W-7405-eng-26.

The equipment and process used for the separation and purification of fission product I^{131} are described. The effect of process variables is discussed in detail. (auth)

721 ORNL-1930

Oak Ridge National Lab., Tenn. THE EXTRACTION OF IRON(III) FROM ACIDIC SULFATE SOLUTIONS BY DI-n-DECYLAMINE SULFATE IN BENZENE. C. F. Baes, Jr. July 25, 1955. Decl. Nov. 16, 1955. 41p. Contract W-7405-eng-26.

Iron(III) extraction coefficients have been measured at 25°C in the liquid-liquid extraction system di-n-decylamine sulfate (DDAS)-benzene, H_2SO_4 - Na_2SO_4 as a function of H_2SO_4 , SO_4^{2-} , Fe^{3+} , and DDAS concentrations. The results are consistent with the extraction of the hydrolyzed complex $FeOHSO_4$ to form both monomeric and dimeric Fe^{3+} species in the benzene phase. The limiting mole ratio, $Fe^{3+}:(R_2NH_2)_2SO_4$, appears to be unity. The Fe^{3+} extraction results and results of the extraction of sulfuric acid by DDAS are discussed in terms of association of DDAS molecules in the benzene phase. (auth)

722 RMO-2502

Rohm and Haas Co. [Research Labs.], Philadelphia. PROGRESS REPORT FOR JULY 1, 1951-AUGUST 15, 1951. Robert Kunin. Aug. 20, 1951. Decl. Sept. 23, 1955. 13p. Contract AT(49-1)-535.

Results are reported of a study of the effects of porosity on the U capacity of the Amberlite IRA-400 (quaternary) anion exchange resins. The capacity of Amberlite IRC-50 for U has been determined for NaCl and $CaCl_2$ solutions containing U. Results of an investigation of the electrolysis of U in H_3PO_4 solution across cation exchange membranes are discussed. The rates of U adsorption from uranyl sulfate solutions and from H_3PO_4 with ion exchange resins are reported. (auth)

723 RMO-2503

Rohm and Haas Co. Research Labs., Philadelphia. RECOVERY OF URANIUM WITH ION EXCHANGE RESINS. Progress Report for August 15, 1951 to October 1, 1951. Robert Kunin. Oct. 9, 1951. Decl. Sept. 23, 1955. 12p. Contract AT(49-1)-535.

Tests on samples of Amberlite IRA-400 that have been through many cycles at Watertown and in South Africa on leach liquor have demonstrated that the resin has not deteriorated either chemically or physically. Drop-off in U break-through capacity has been attributed to accumulation of insoluble extraneous constituents and possibly tightly adsorbed complexes. Economic studies on the membrane purification of U have indicated a low electrical consumption. Further studies have shown that NH_3 is a by-product of this operation. Similar results may be realized on using the same membrane cell for recovering MnO_2 from the barren effluents. (auth)

724 RMO-2504

Rohm and Haas Co. Research Labs., Philadelphia. RECOVERY OF URANIUM WITH ION EXCHANGE RESINS. Progress Report for October 1, 1951-January 1, 1952. Robert Kunin. Jan. 7, 1952. Decl. Sept. 23, 1955. 24p. Contract AT(49-1)-535.

The U elution characteristics of several quaternary anion exchange resins have been examined. These resins were used to separate U from Rand and Belgian Congo leach liquors. The Mn and H_2SO_4 were subsequently recovered by electroprecipitation. The electrolytic recovery of U employing exchange membranes has been studied. An anion-exchange resin was selected for resin-in-pulp operation. (For preceding period see RMO-2503.) (C.W.H.)

725 RMO-2607

Merrill Co., San Francisco.

ELECTROLYSIS OF CARBONATE LEACH SOLUTIONS.

John C. Huggins. July 31, 1952. Decl. Aug. 18, 1955.

23p. Contract AT(49-1)-540.

An interim report covering electrolytic studies made to July 31, 1952 on the reduction of carbonate leach solutions is outlined. The results demonstrate the feasibility of a diaphragm cell for recovery by electrolysis of both V and U in carbonate leach solutions. The work also indicates that conventional diaphragm materials are satisfactory and tests are reported for diaphragms of several different materials. Solutions may be derived from the electrolytic operation which are suitable for reuse in a practical cyclic leaching process. (J.E.D.)

726 UCRL-2674

California. Univ., Berkeley. Radiation Lab.

PURIFICATION OF MILK FOR CALCIUM AND STRONTIUM WITH DOWEX-50 W RESIN.

W. E. Nervik, M. I. Kalkstein, and W. F. Libby. Aug. 12, 1954. Decl. Nov. 7, 1955. 13p. Contract W-7405-eng-48.

Purification of milk for radiostrontium by treatment with Dowex-50 W resin in the sodium form, both by a column and a bulk technique, has been shown to be effective. Nearly 90% of the tracer isotopes of both calcium and strontium has been removed. Spectrographic analysis shows exchange to have been essentially complete since the bulk calcium present in the milk had been removed to about the same percentage. (auth)

727 WIN-13

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

URANIUM RECOVERY BY HYDROGEN REDUCTION OF CARBONATE LEACH LIQUORS.

Harry Papazian. Nov. 1, 1955. 25p. Contract AT(49-6)-924.

The application of H_2 reduction in the presence of a Ni catalyst for the recovery of U from carbonate liquors has been investigated. Tests were conducted on a laboratory scale in batch and continuous operations. (auth)

728 WIN-24

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

THE RECOVERY OF URANIUM FROM SULFATE LEACH LIQUORS BY THE TBP-THIOCYANATE PROCESS.

Henry G. Petrow and Harold N. Marenburg. Nov. 7, 1955. 17p. Contract AT(49-6)-924.

A process for the solvent extraction of U from clear sulfate leach liquors has been developed. The uranium is extracted into a tributyl phosphate-kerosene solvent as uranyl thiocyanate. The extracted uranyl thiocyanate is reextracted into aqueous Na_2CO_3 . Laboratory data indicate the process to be economically applicable to plateau ores. (auth)

729

A SINGLE VANE CYCLONE SEPARATOR. G. D. Joglekar

and N. R. Subramanian (National Physical Lab. of India, New Delhi). *J. Sci. Ind. Research (India)* **14A**, 419-26(1955) Sept.

The incorporation of a single vane in the usual cyclone collector to control the inflow of air from the tangential to radial directions provides an easy means of getting different sized fractions. The vane works both in low and high velocity cyclones and with materials varying considerably in physical characteristics. (auth)

730

SEPARATION OF ZIRCONIUM AND HAFNIUM USING ANION EXCHANGE RESINS. PART I. QUALITATIVE STUDIES.

K. S. Rajan and J. Gupta (National Chemical Lab. of India, Poona). *J. Sci. Ind. Research (India)* **14B**, 453-6(1955) Sept.

The progressive removal of Hf from Zr salts in a natural mixture of the two by the anion exchange resin Amberlite IRA 400 has been investigated. The fluoro-complexes of Zr and Hf are eluted with H_2SO_4 when Hf separates out in the first fractions. A maximum recovery of 90% of Hf-free zirconia has been obtained. (auth)

731

SLOW PRECIPITATION PROCESSES. APPLICATION OF PRECIPITATION FROM HOMOGENEOUS SOLUTION TO LIQUID-SOLID DISTRIBUTION STUDIES. Louis Gordon (Syracuse Univ., N. Y.). *Anal. Chem.* **27**, 1704-7(1955) Nov.

The direct addition of a precipitant to a solution results temporarily in a heterogeneity of conditions. In the vicinity where the precipitant has been introduced, the formation of the solid phase takes place under conditions such that the solution concentrations vary between very wide limits. Therefore, results of coprecipitation studies obtained with conventional precipitation procedures may also vary markedly. Precipitation from homogeneous solution offers an ideal technique for controlling the rate and mode of addition of a precipitant. It permits a slow precipitation process, which allows near equilibrium to be established between the surface of the solid and the solution. It is thereby possible to determine the nature and extent of coprecipitation. Applications of this technique are described in which Doerner-Hoskins' distribution coefficients have been obtained for systems containing barium-radium mixtures. Other coprecipitation studies are also described, particularly some which have revealed that the extent of coprecipitation is negligible except during the initial and final stages of the precipitation process. (auth)

732

COPRECIPITATION OF THALLIUM(I) WITH SILVER CHLORIDE. PRECIPITATION FROM HOMOGENEOUS SOLUTION. Louis Gordon, J. I. Peterson, and B. P. Burt (Syracuse Univ., N. Y.). *Anal. Chem.* **27**, 1770-4 (1955) Nov.

The coprecipitation of Tl^+ with AgCl from homogeneous solutions has been studied. The Tl -Ag ratio in AgCl crystals was found to be dependent on the solution concentration of the Tl^+ , and independent of the Ag^+ concentration. An apparent homogeneous distribution of Tl within AgCl crystals was obtained. (C.W.H.)

733

EXTRACTION OF URANIUM BY 8-QUINOLINOL AND ITS DERIVATIVES. Charles L. Rulfs, Anil K. De, Julian Lakritz, and Philip J. Elving (Univ. of Michigan, Ann

Arbor). *Anal. Chem.* 27, 1802-4(1955) Nov.

The extraction of U^{6+} with 8-quinolinol and several of its derivatives has been studied. The pH ranges most suitable for extraction into chloroform are 5.8 to 8.0 for uranyloxinate, 5.4 to 7.2 for uranyl dichlorooxinate (derived from 5,7-dichloro-8-quinolinol), and 5.6 to 7.3 for uranyl dibromooxinate (derived from 5,7-dibromo-8-quinolinol); the resulting bright orange colored metal complex solutions can be best measured spectrophotometrically at 430, 420, and 420 m μ , respectively. (auth)

734

SEPARATING AND PURIFYING REACTOR FUEL FROM URANIUM-ORE CONCENTRATES. Wilbur E. Kelley (Catalytic Construction Co., Philadelphia). *Nucleonics* 13 No. 11, 68-71(1955) Nov.

Refer also to abstracts 742, 745, and 839.

SORPTION PHENOMENA

735 AECU-3083

Illinois. Univ., Urbana.

VAPOR AND LIQUID PHASE REACTIONS BETWEEN NITROGEN DIOXIDE AND WATER. M. S. Peters and J. L. Holman. [1954]. 18p. Contract [AT 11-1 -276].

Results indicate that both gas-phase and liquid-phase reactions occur in the removal of nitrogen dioxide from gases by contact with aqueous solutions. The major part of these reactions does not occur in the bulk phases but takes place in the gas film and liquid film at the boundaries between the two phases. (auth)

736

APPLICATION OF LABELED ATOMS IN INVESTIGATION OF SULFURIC ACID ADSORPTION ON PLATINUM COATED PLATINUM. N. A. Balashova (Inst. of Physical Chemistry) *Doklady Akad. Nauk S.S.S.R.* 103, 639-42(1955) Aug. 1. (In Russian)

SPECTROSCOPY

Refer also to abstracts 994, 1116, and 1118.

SYNTHESES

737 NP-5799

Southwest Research Inst., San Antonio.

POLYNUCLEAR AROMATIC COMPOUNDS FOR HIGH TEMPERATURE LUBRICANTS. Quarterly Report No. 3 [for] June 1, 1955-September 1, 1955. Technical Report No. 12. Charles F. Raley, Jr. Project 10-250-A. Contract AF33(616)-276.

The technique of reacting stoichiometric proportions of selected mixed phenols with phosphorus oxychloride to give rise to physical-chemical mixtures has been found suitable for the production of thermally stable fluids with a liquid range of at least -20 to 800°F. Several compositions of matter were so prepared and in most cases the upper limit was exceeded, and sometimes the lower limit. Further attempts to prepare a silicon-phosphorus compound were unsuccessful. (For preceding period see NP-5696.) (auth)

738 NP-5807

Hooker Electrochemical Co., Niagara Falls, N. Y.

INVESTIGATION AND DEVELOPMENT OF CONDENSATION TYPE ELASTOMERS. Bimonthly Progress Report No. 8 [for] August 1, 1955 to October 15, 1955. G. C. Schweiker, R. R. White, and R. N. Deleo. 24p. Contract AF33(616)-2421.

Progress is reported in studies on the development of elastomers having high thermal stability; resistance to aromatic fuels, synthetic ester-base oils, and hydraulic fuels; resistance to ozone and to weathering oxidation effects; resistance to acids, bases, and salts; resistance to abrasion; and satisfactory performance at -65°F or lower temperature. Diethyl perfluoroglutarate, 2, 2, 3, 3, 4, 4-hexafluoropentanediol, 2, 2, 3, 3, 4, 4, 5, 5-octafluorohexanediol, and glutaryl chloride were prepared as intermediates or starting materials. New polyesters of these materials were prepared. A series of hexafluoropentylene adipate polymers were made with progressively increasing mol ratio of adipyl chloride to diol. High-molecular-weight hexafluoropentylene adipate was prepared and changes in viscosity with temperature were measured. Data are included on cross-linking hexafluoropentylene adipate with dicumylperoxide, reinforcing polyesters, and the effects of aging on the specimens prepared. (See also WADC-TR-55-221.) (C.H.)

739 WADC-PR-55-1

Pennsylvania Salt Mfg. Co., Philadelphia.

PREPARATION OF POLYMERS FROM HALOGEN-SUBSTITUTED OLEFIN AND DIENE MONOMERS. [Progress Report for July to October 1955]. John T. Barr, Jr., Hyman Iserson, and Francis E. Lawlor. Oct. 1955. 38p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF 33(616)-3137.

The objective of this work is the synthesis and polymerization of a series of chlorofluorobutadienes and other related olefinic materials and the preliminary evaluation of the resulting polymers. A literature survey of fluorine containing monomers and polymers from January 1, 1954 through June 1955, required under the contract has been completed and is made a part of this report. Monomeric compounds synthesized during the period are listed. All but two have been polymerized. Attempts to prepare alkoxy-substituted butadienes have been only partially successful and no polymers were obtained because of hydrolysis. (auth)

740

THE BIOSYNTHESIS OF METHIONINE FROM HOMOCYSTEINE AND METHYLMETHIONINE SULFONIUM SALT. Stanley K. Shapiro (Argonne National Lab., Lemont, Ill.). *Biochim. et Biophys. Acta* 18, 134-5(1955).

TRACER APPLICATIONS

Refer also to abstracts 623 and 726.

TRANSURANIC ELEMENTS AND COMPOUNDS

741 AECU-3085

Los Alamos Scientific Lab., N. Mex.

THE CRYSTAL STRUCTURE AND THERMAL EXPANSION

OF GAMMA PLUTONIUM. W. H. Zachariasen and F. H. Ellinger. [1954]. Decl. Dec. 13, 1954. 16p. Contract [W-7405-eng-36].

Gamma plutonium is found to be orthorhombic with eight atoms in a unit cell of dimensions [at 235°C] $a_1 = 3.1587 \pm 0.0004$ Å, $a_2 = 5.7682 \pm 0.0004$ Å, $a_3 = 10.162 \pm 0.002$ Å. The calculated density is 17.14 ± 0.01 g/cm³. The space group is Fddd and the positions of the eight atoms are: (0 0 0) (0 $\frac{1}{2}$ $\frac{1}{2}$) ($\frac{1}{2}$ 0 $\frac{1}{2}$) ($\frac{1}{2}$ $\frac{1}{2}$ 0) ($\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$) ($\frac{3}{4}$ $\frac{3}{4}$ $\frac{3}{4}$) ($\frac{3}{4}$ $\frac{1}{4}$ $\frac{3}{4}$) ($\frac{3}{4}$ $\frac{3}{4}$ $\frac{1}{4}$). Each plutonium atom is bounded to ten others at an average distance of 3.157 Å, four being at 3.026 Å, two at 3.159 Å and four at 3.288 Å. The mean linear coefficients of thermal expansion are found to be $10^6 \alpha_{[100]} = -19.7 \pm 1.0$ /°C, $10^6 \alpha_{[010]} = 39.5 \pm 0.6$ /°C, $10^6 \alpha_{[001]} = 84.3 \pm 1.6$ /°C. (auth)

URANIUM AND URANIUM COMPOUNDS

742 ACCO-30

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass. PRELIMINARY LEACHING TESTS FOR THE EXTRACTION OF URANIUM FROM VARIOUS MONTICELLO STOCKPILE ORES. Charles S. Abrams, Harry D. Moulton, and Hans I. Viklund. Mar. 2, 1953. Decl. Sept. 23, 1955. 39p. Contract AT(49-1)-533.

Six samples of Monticello Stockpiles were leached with varying amounts of H₂SO₄ at 50% solids and room temperature for 4 hours. Uranium extractions from 85 to 98% were obtained with 100 to 400 pounds of acid per ton. In general, increased leaching time, use of NaClO₃, finer grinding, had very little effect on U extraction. The V extractions were 20 to 30%. With one exception the ores settled well when 0.5 pound of carboxy-methyl cellulose was used. Thickener area requirements of from 2 to 8 sq. ft. per ton per day were obtained. The filter rates for 4 samples with 0.5 pound of CMC per ton were 0.6 to 1.2 tons per sq. ft. per day. Filter rates for 2 samples were 0.4 to 0.6 tons per sq. ft. per day with a cake thickness less than $\frac{1}{4}$ in. Soluble losses during single stage filtration were high enough to require repulping with H₂O and re-filtration. (auth)

743 AECU-3098

Knolls Atomic Power Lab., Schenectady, N. Y. RECRYSTALLIZED TEXTURE OF ALPHA URANIUM. W. Seymour and J. Duffey. [1954]. Decl. Jan. 11, 1955. 13p. Contract W-31-109-Eng-52.

Uranium was plastically deformed 90% at room temperature by uni-directional rolling to a foil 0.002-in. thick. Specimens were recrystallized in the alpha region and several pole figures obtained from 0 to 40°. From these, the preferred orientation was found to be a spread of an idealized (100) [010] about [010]. (auth)

744 CC-3489

California. Univ., Berkeley. [Radiation Lab.] THE U⁴⁺-UO₂⁺⁺ COUPLE IN H₂SO₄ AND THE U³⁺-U⁴⁺ COUPLE IN HCl. D. Cubicciotti. Mar. 19, 1946. Decl. Aug. 26, 1954. 16p. Contract W-7405-eng-48b.

Measurements have been made on the equilibrium between Cu, Cu²⁺, U⁴⁺, and UO₂²⁺ in H₂SO₄ in an attempt to establish the value of the U⁴⁺-UO₂²⁺ couple potential. The value of the formal potential for the U³⁺-U⁴⁺ couple in 1N HCl at 0°C was determined to be + 0.65 v. (C.W.H.)

745 DOW-92

Dow Chemical Co. Western Div., Pittsburg, Calif. THE RECOVERY OF URANIUM AND OTHER VALUES FROM FLORIDA LEACH ZONE MATERIAL. Progress Report for January 1953. Research Dept. R. H. Bailes. Jan. 28, 1953. Decl. Sept. 29, 1955. 42p. Contract AT-30-1-GEN-236.

An investigation of the recovery of uranium from nitric acid leaches of Florida leach zone material by solvent extraction with octyl pyrophosphoric acid and tributyl phosphate is reported. A study of caustic leaching of the ore and recovery of uranium by precipitation methods is presented. (For preceding period see DOW-91.) (auth)

746 IDO-14313

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PHASE STUDIES OF AQUEOUS SOLUTIONS OF URANYL NITRATE AND AMMONIUM HYDROXIDE. H. W. Miller. Sept. 27, 1954. Decl. Aug. 22, 1955. 8p. Contract AT(10-1)-205.

Uranyl nitrate solutions, made acid-deficient by the addition of ammonium hydroxide, may precipitate either as ammonium diuranate or as the hydrated uranyl nitrate. Ammonium diuranate precipitates at a pH of 2.8 from uranyl nitrate solutions of concentrations below 1.0M. This represents an acid deficiency value between 0.4M and 0.5M. Precipitation of ammonium diuranate was not observed in more concentrated solutions of uranyl nitrate made acid-deficient to the extent of 0.7M ammonium hydroxide. A eutectic curve was determined from melting point curves for 0.9 to 2.0M uranyl nitrate in the presence of 0.0 to 0.6M ammonium hydroxide. The melting points and eutectic temperatures are not greatly affected, over the acid-deficient region studied. (auth)

747 MCW-248

Mallinckrodt Chemical Works, St. Louis. MCW ACCOUNTABILITY PROGRAM. Progress Report. C. H. Walden. Mar. 3, 1950. Decl. Nov. 2, 1955. 4p.

The physical losses of U in the Plant 6 manufacturing area are reviewed. Modifications in the existing sewage samplers are proposed. (C.W.H.)

748 NYO-5119

[Mallinckrodt Chemical Works, St. Louis]. PRODUCTION DEPARTMENT SAMPLING PROCEDURE IN PLANT 4 [UF₄ PLANT]. C. M. Bemis. May 22, 1945. Decl. Nov. 2, 1955. 7p.

Sampling procedures are described and discussed for chemicals handled in the UF₄ production plant. (L.D.)

749

INNER-METALLIC COMPLEX SALTS OF SALICYLALDIMINO ACIDS WITH POLYCYCLIC RINGS. PART II. Ajit Kumar Mukherjee and Priyadarajan Ray (Indian Assoc. for the Cultivation of Science, Calcutta). J. Indian Chem. Soc. 32, 505-9(1955) Aug.

Several complex metal chelate compounds of U⁴⁺ and V⁴⁺ with salicylaldehyde and amino acids like glycine, alanine, anthranilic acid, and sulphanic acid have been prepared and their properties studied. Possible structure for the compounds has also been suggested. (auth)

750

DETERMINATION OF LIGHT INTENSITIES WITH A HIGHLY SENSITIVE URANYL OXALATE ACTINOMETER. James N. Pitts, Jr., J. David Margerum, R. Perry Taylor, and Warren Brim (Univ. of California, Riverside and

Northwestern Univ., Evanston, Ill.). *J. Am. Chem. Soc.* 77, 5499-5501(1955) Nov. 5.

A method, employing the technique of differential absorption spectrophotometry to determine the amount of oxalate decomposed, is described for increasing the sensitivity and convenience of the uranyl oxalate actinometer. (C.W.H.)

751

URANIUM(III) CUPFERRATE. Charles L. Rulfs and Philip J. Elving (Univ. of Michigan, Ann Arbor). *J. Am. Chem. Soc.* 77, 5502-3(1955) Nov. 5.

Polarographic studies indicate the existence of a very stable ether-soluble uranium (III) cupferrate. (C.W.H.)

752

COULOMETRIC TITRATIONS WITH ELECTROLYTICALLY GENERATED URANOUS ION. W. D. Shults, II, P. F. Thomson, and M. T. Kelley (Oak Ridge National Lab., Tenn.). *Anal. Chem.* 27, 1750-1(1955) Nov.

Results show that Ce^{4+} and Cr^{6+} can be reduced with 100% current efficiencies by use of U^{4+} as a coulometric intermediate. The U^{4+} was generated electrolytically with constant current at a Pt cathode, which was immersed directly in the test solution. The end point was detected by means of a Pt wire-saturated calomel electrode system, and the electrolysis time was measured automatically. (auth)

753

ON THE PREPARATION OF LARGE U CRYSTALS BY CHANGE OF PHASE. Pierre Lehr. *Compt. rend.* 241, 1043-4(1955) Oct. 17. (In French)

Preparation of U monocrystals by the change-of-phase method is proposed, and their orientation and degree of perfection were studied by x rays. (tr-auth)

Refer also to abstracts 566, 605, 608, 615, 616, 660-663, 665, 666, 667, 669-717, 723, 724, 725, 727, 728, 777, 851, 879, and 1144.

WASTE DISPOSAL

754 NYO-4641

New York Univ., New York. Coll. of Engineering. REMOVAL OF RADIOACTIVITY FROM LAUNDRY WASTES BY TRICKLING FILTERS. Final Report. William E. Dobbins, Gail P. Edwards, and Wladimir Gulevich. May 1955. 47p. Contract AT-30-1-1246.

A radioactive laundry waste containing fission products was treated continuously on single- and two-stage trickling filters. The results indicate that about 90% of the gross activity of mixed fission products can be removed at organic loading of 250 pounds biochemical oxygen demand (BOD) per acre foot day. The percentage removal decreased with increase in loading. Sludge was produced at a rate of about 0.3 pounds dry solids per pound BOD removed. The activity level reached by the sludge is shown to be essentially independent of loading rate but dependent on the activity level of the waste. Removals of individual radioisotopes were obtained as follows: Ce, 97.3%; Ru, 79.1%; Sr, 69.4%; Y, 86.7% and Zr-Nb, 79.5%. (auth)

755

ESTIMATION OF CURIE CONTENT OF PACKAGED RADIOACTIVE WASTES. Frederick B. Oleson (Brookhaven National Lab., Upton, N. Y.). *Arch. Ind. Health* 12, 383-7(1955) Oct.

At Brookhaven National Laboratory solid radioactive wastes are packed in concrete-lined barrels for sea burial. Most of the activity comes from mixed fission products over one year old. In order to determine the amount of activity thus disposed of, it is necessary, in practice, to relate the mr/hr readings of gamma survey instruments at a specified distance from the barrels to the activity in curies. To make this relationship quantitative, it has been necessary to obtain a known amount of the activity in highly concentrated liquid form and to make a measurement of the r/hr per curie of total activity at 1 ft for various thicknesses of the concrete lining. An analysis of the gamma-ray energy spectrum using a gray-wedge spectrometer showed that over 95% of the gammas had an energy of 0.66 Mev. This was attributed to Cs^{137} - Ba^{137} in the mixture. The fact that other gamma energies were not significantly present simplified the problem. On theoretical grounds, other isotopes present such as Sr^{90} and Pm^{147} have very simple decay schemes and are pure beta emitters. Thus, it could be shown that every disintegration was accompanied by a detectable beta. The beta activity was approximately 2.0 times the gamma activity. The effective absorption coefficient of ordinary and heavy concrete in the cylindrical geometry for Co^{60} and methods for estimating the activity of material with Co^{60} contamination are discussed. (auth)

ENGINEERING

756 AD-28714

General Electric Co. Transformer and Allied Products Div., Pittsfield, Mass.

HIGH POWER-HIGH VOLTAGE PULSE TRANSFORMER. PART I. DESIGN CRITERIA AND DATA. Final Report covering the period June 1, 1950 through November 30, 1952. P. Fenoglio, C. W. Peck, F. R. Richardson, H. W. Lord, and A. Boyajian. Feb. 1, 1953. 267p. Project DA-3-26-00-600. Contract DA36-039-sc-117.

The information necessary to acquaint an inexperienced person with the principles of pulse transformer design and the necessary design data are given. Equivalent circuits, windings, cores, insulations, and cooling are discussed. A procedure for the design of a pulse transformer is outlined. Methods are given for calculating required transformer parameters from the overall transformer and circuit requirements as given in the specifications and from the characteristics of the simplified equivalent circuit. (D.E.B.)

757 AECD-3651

Los Alamos Scientific Lab., N. Mex.

A DESCRIPTION OF TWO MOTOR-OPERATED VALVES AND A SPECIAL VALVE PACKING. J. W. Anderson, W. C. Hazen, R. L. Thomas, and W. D. McNeese. Sept. 14, 1953. Decl. with deletions Mar. 15, 1955. 18p. Contract W-7405-eng-36.

This report describes normally open or closed type valves, and throttling control valves, developed for use in remote-control equipment where flows are small but precise control is required. These valves were developed to handle such materials as ammonia, acid solutions, liquids containing solids, etc. A special valve packing used to prevent leaks at the valve stem is also described. (auth)

758 AECU-3037

General Services Administration, Washington, D. C.
WINDOW AND GLASS HAZARDS UNDER WARTIME
CONDITIONS AND RECOMMENDED PROTECTIVE
MEASURES. Walton C. Clark. 1954. 14p.

759 HW-37983

Hanford Atomic Products Operation, Richland, Wash.
JOINT DESIGN FOR JOINING TUBES TO TUBE SHEETS
FOR CORROSIVE RADIOACTIVE CHEMICAL SERVICE.
W. R. Smith. Aug. 18, 1955. 18p. Contract W-31-109-
Eng-52.

Stainless steel tubes have been joined to tube sheets by
a fabrication method which combines welding and rolling
techniques. Results of corrosion studies indicate that the
joints were as corrosion resistant as the base materials.
(C.W.H.)

Refer also to abstract 897.

HEAT TRANSFER AND FLUID FLOW

760 AD-40932

California Inst. of Tech., Azusa. Hydrodynamics Lab.
NOTE ON THE DYNAMICS OF SMALL VAPOR BUBBLES
IN LIQUIDS. Report No. 26-7. S. A. Zwick and M. S.
Plesset. Feb. 1954. 37p. Contract N6onr-24416.

The equations of motion for a spherical vapor bubble in
a liquid are obtained and applied to the cases of a bubble
growing in superheated liquid and a bubble collapsing in a
liquid below the boiling point, under the assumption that
heat transfer effects accompanying the bubble growth of
collapse are dynamically important. The liquid is taken
to be incompressible and nonviscous; the vapor is assumed
to be in thermal and dynamic equilibrium with the liquid.
(auth)

761 AERE-GP/M-182

Gt. Brit. Atomic Energy Research Establishment,
Harwell, Berks, England.

THE MOLECULAR FLOW CONDUCTANCE OF A
PIPE OF ELLIPTICAL CROSS-SECTION. A. H. Turnbull.
Aug. 4, 1955. 8p.

The molecular flow conductance of a pipe of elliptical
cross-section for air at room temperature is calculated.
End effects are neglected assuming that the pipe is long
compared with the major axis of the ellipse. (auth)

762 NP-5797

Connecticut. Univ., Storrs.

THE COMPRESSIBILITY AND HEAT TRANSFER OF
HELIUM II. Technical Report [for] July 15, 1953-55.
Harold Forstat and Charles A. Reynolds. 1955. 25p.

It has been demonstrated that the thermomechanical
effect operates in a closed system of helium II. This effect
has been used to measure the compressibility of He II. The
results agree relatively well with the results of other in-
vestigators who used other methods. The agreement in-
dicates that the method used, a packed column of rouge in
a closed system, is a good one for obtaining the full thermo-
mechanical effect. The heat transfer of He II in the rouge
column has been measured. The behavior found is, in
general, similar to that found for the heat transfer through
a slit between two optically polished surfaces. Evidence
was found for a maximum in the heat transfer close to, but
below, the λ -point. (auth)

763 ORO-139

Tennessee. Univ., Knoxville.

EFFECT OF GAS ENTRAINMENT ON THE HEAT TRANS-
FER CHARACTERISTICS OF MERCURY UNDER TURBU-
LENT FLOW CONDITIONS. Final Report. Harold
Chelemer. June 1955. 169p. Contract AT(40-1)-1310.

Experimental heat transfer data were obtained under
wetting and non-wetting conditions for dilute sodium
amalgam and pure mercury in turbulent flow inside steel
tubes. Investigations were conducted with either of two
horizontal test sections having inside diameters of $\frac{3}{8}$ inch
and $\frac{1}{4}$ inch. Heat was supplied by passing currents through
the wall of the tube resulting in nearly uniform heat fluxes.
The fluid was delivered to the test sections by gravity flow
from a head tank or by direct pumping. Visual studies of
the flowing mercury were carried out using a glass tube
in place of a test section. Gas entrainment, indicated by
visible bubbles in the mercury, led to low heat transfer
rates which were increased by increasing the static pres-
sure. Suitable changes in the flow system resulted in a
reduction of this entrainment effect and an increase in heat
transfer performance. Operating under wetting conditions
and at increased static pressures had no effect on heat
transfer rates obtained with reduced entrainment. This
behavior was explained by a consideration of the adverse
effect of entrained gas bubbles on the thermal conductivity
of the liquid. Methanol heat transfer tests were conducted
in the system, the experimental results being in excellent
agreement with predicted results. The experiments sub-
stantiated the accuracy of the operating and calculation
procedures used and supported the validity of the mercury
heat transfer results. (auth)

764 WADC-TR-54-66

Ohio State Univ. Research Foundation, Columbus.
HEAT-TRANSFER FLUIDS FOR AIRCRAFT-EQUIPMENT
COULING SYSTEMS. [Period covered] December 1952 to
January 1954. C. J. Geankoplis, W. B. Kay, A. W. Lemmon
Lemmon, and W. Robinson. Feb. 1954. 181p. Contract
AF33(616)-147. (AD-50566)

Data on the physical, chemical, and physiological proper-
ties of 36 fluids are tabulated. The types of fluids rep-
resented are aqueous solutions, hydrocarbon fuels, hydrau-
lic fluids and lubricants, oxygenated hydrocarbons, fluoro-
and chloro-hydrocarbons, organic-inorganic compounds,
and silicones. Among fluids having a freezing point of
-65°F or lower, aqueous solutions, especially a methanol-
water mixture and an ethylene glycol-water mixture, have
the best properties. The effects of the choice of a heat
transport fluid on the overall aircraft penalty imposed by
a centralized cooling system were evaluated for various
types of cooling systems. (M.P.G.)

765 AEC-tr-2314

INVESTIGATIONS OF THE DENSITY DISTRIBUTION,
WATER AND STEAM VELOCITIES AS WELL AS THE
PRESSURE LOSS IN VERTICAL AND HORIZONTAL
UP-FLOW BOILER TUBES. Karl Schärz. Translated
from VDI-Forschungsheft 20B, No. 445, 1-44(1954). 152p.

Measurements were carried out with the purpose of
obtaining reliable data for calculating the water circulation
in natural circulation boilers. By using a full-size boiler
model and applying novel measuring methods, the circulating
water and steam rates, the distribution of density, and the
velocities of water and steam flow were established for the
vertical and horizontal sections of up-flow tubes during

operation as well as the pressure loss for the vertical section. Hitherto when calculating the water circulation, the lead velocity of steam had been based upon values established for stationary water, and the friction coefficient determined for homogeneous liquids. The new values now obtained for circulating water-steam mixtures show substantial deviations from the values known up to this time, resulting in a decisive revision of the calculation of water circulation. (auth)

766 AEC-tr-2317

THE TEMPERATURE FIELD IN A STEEL VESSEL AT HIGH PRESSURE. L. F. Vereschagin and Ya. A.

Kalashnikov. Translated from *Doklady Akad. Nauk S.S.S.R.* 99, 745-8(1954). 7p.

An explanation, based on convection-current analysis, is proposed for the observed reduction in temperature as the pressure is increased in steel high-pressure vessels. (C.W.H.)

767 NACA-TM-1147

GENERAL CHARACTERISTICS OF THE FLOW THROUGH NOZZLES AT NEAR CRITICAL SPEEDS. (Allgemeine Eigenschaften Der Strömung Durch Düsen In Der Nähe Der Kritischen Geschwindigkeit). R. Sauer. Translated by Dave Feingold from *Deutsche Luftfahrtforschung*, Forschungsbericht Nr. 1992. Sept. 25, 1944. 20p.

The characteristics of the position and form of the transition surface through the critical velocity are computed for flow through flat and round nozzles from subsonic to supersonic velocity. Corresponding considerations were carried out for the flow about profiles in the vicinity of sonic velocity. (auth)

768 TT-554

HEAT TRANSFER IN FLUIDIZED BEDS. (Wärmetübertragung in Gaswirbelschichten). E. Wicke and F. Fetting. Translated by John Klassen from *Chem. Ing. Tech.* 26, 301-09(1954). 33p.

Heat transfer was investigated in beds fluidized with air, CO_2 , and H_2 using a heating element of the immersion heater type. The variations in heat transfer were investigated for varying fluid velocity (1 to 150 cm per sec) and different bed materials (quartz sand, glass, SiC, abrasive dust, Al and Pb powder with grain sizes from 0.065 to 3 mm). In almost all cases the heat transfer coefficients at increasing gas velocity showed a characteristic maximum which increased for decreasing grain size and increasing thermal conductivity of the fluidizing gas from 200 to over 1300 kcal/sq m hr $^{\circ}\text{C}$. For interpretation of heat transfer conditions a model concept is developed which takes into account the heat conduction through a gas film adjacent to the wall and a stream of particles along the wall of the heating element, as well as the heat convection. Calculations based on the model yield a decrease of heat transfer coefficient along the wall which agrees with the values found experimentally. An approximation formula enables the measurements to be correlated in non-dimensional form with those of other authors. One tenth to one half the grain diameter is used for the thickness of the adjacent gas film. In conclusion, a few still unclarified effects are discussed. (auth)

769

HEAT TRANSFER. RESEARCH STUDIES FOR 1954.

F. J. Van Antwerpen, ed. *Chem. Eng. Progr.* 50, Symposium Ser. No. 9, 1954. 67p.

Beds composed of various sizes of five different solids

were examined for the purpose of determining the effects of the numerous variables on the heat-transfer coefficient between the container wall and the fluidized bed. Empirical correlations which fit the data are presented. Heat transfer by free convection through a layer of H_2O or CCl_4 bounded by a lower horizontal heating surface and an upper horizontal cooling surface was studied. Correlations which represent the experimental data are presented. The nature of the heat transfer coefficient varied from 21 to 57.8 B.t.u./hr $\text{ft}^2\text{F}^{\circ}$ for CCl_4 and from 16.6 to 166.5 B.t.u./hr $\text{ft}^2\text{F}^{\circ}$ for H_2O . Convection heat-transfer coefficients for the cooling of steam and air flowing in a 2-in. pipe were measured from 500 to 1200 $^{\circ}\text{F}$ at gas-to-wall temperature differentials of 300 to 1000 $^{\circ}\text{F}$ over a range of Reynolds numbers from 2,000 to 20,000 for air and 5,000 to 60,000 for steam. Effects of entrance conditions on convection coefficients are considered. Suspensions composed of a number of powdered solids in H_2O and ethylene glycol have been investigated as heat transfer media. Equations applicable to liquids were found to be applicable to suspensions if the thermal conductivity and viscosity of the suspension were properly evaluated. Pressure drop and heat transfer for an air - H_2O mixture flowing in a horizontal 0.737-in. pipe were investigated where the flow of both phases was always turbulent. Problems in the design of light-hydrocarbon pyrolysis coils are discussed. Literature and experimental data are analyzed to show the effects of wetting and gas entrainment on heat transfer to molten metals. (D.E.B.)

770

ON MASS EXCHANGE IN PLATE TYPE COLUMNS. A. G. Evstaf'ev, D. D. Zykov, and N. M. Karavaev. *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk*, No. 8, 119-27(1955) Aug. (In Russian)

Distillation mathematical analysis is given. (R.V.J.)

771

ON STRUCTURE OF LAMINAR FLOW. V. A. Tetynev. *Zhur. Tekh. Fiz.* 25, 1817-8(1955) (In Russian)

Experiments with thermal gravitational convection established that a vertical cylinder with stationary laminary convection has velocities parallel to the axis of the cylinder. Visual observations of a tilting cylinder showed the same parallelism, moreover, the temperature gradient proved to be constant. Later, theoretical calculations proved the impossibility of a constant convectional flow without thermal losses in a tilted unlimited cylinder with velocities strictly parallel to the axis and with a constant temperature gradient along the cylinder. Special experiments to investigate the kinematics of such convectional flow by the method of photographic trajectories of suspended light-diffusing particles were made. Results proved that flow lines in a free stationary thermal convection of a tilted cylinder are not exactly parallel to the axis of the cylinder. In some cases deviations were very slight and the trajectory of the suspended particles seemed to be straight, while in others lines were obviously zigzagging. It is possible that in many other cases of non-turbulent laminar liquid flow the same phenomenon takes place. Photographic plates of experiments are given. (R.V.J.)

772

HEAT TRANSFER. ST. LOUIS. F. J. Van Antwerpen, ed. *Chem. Eng. Progr.* 50, Symposium Ser. No. 17, 1955. 109p.

Measurements were made of the nucleate boiling

coefficients of ether, normal pentane, and Freon 113 from a horizontal heated surface. A vapor-trapping mechanism of nucleate boiling is postulated on the basis of observations. The effect of gas evolution on surface boiling was investigated experimentally. The results support the hypothesis that the marked effectiveness of surface boiling is the result of mechanical action. Heat transfer coefficients for liquid O_2 boiling outside single horizontal tubes and wires were measured in the stable film boiling region. Experimental values of the coefficient were found to vary as $(1/\text{diam.} + \text{const.})$. The performance of specially designed double wall stainless steel tubes was compared with that of a single wall tube in the generation of steam at high heat fluxes. Evaluation of the tube design and bond resistance was made, and a method for calculating the performance of such tubes is presented. Boiling heat transfer coefficients were measured for Hg, Hg + 0.1% Na, and Hg 0.02% Mg and traces of Ti, Na, Na-K alloy, and Cd at temperatures from 670 to 1600°F and atmospheric pressure. Evidence indicates that film boiling may be the result of nonwetting characteristics rather than heat flux or quantity of vapor evolved. Several mathematical analyses for forced-convection heat transfer in the thermal entrance region of low Prandtl modulus systems are presented. The over-all rate and the angular variation of the rate of convective heat transfer from an unconfined gas stream at high temperature to a circular cylinder normal to the flow were measured on a N_2 gas stream at 1 atm. pressure. Previous correlations for convective heat transfer based on experiments with small temperature differences did not adequately represent the data obtained in this investigation. The graphical correlations obtained are presented. In the melting of solids, the heat transmission is controlled by the extent of the liquid film. At a given melting rate the thickness of the film will be determined by the viscosity, density, angle of inclination, and the pressure gradient set up in the film by the solid. Differential equations for these variables are given. Rates of heat transfer were determined between a petroleum solvent and H_2O flowing in a horizontal circular pipe. The rate of heat exchange was found to be proportional to the flow rate. Heat transfer to a fluid flowing in laminar motion through a vertical tube is considered mathematically. The calculated values are found to agree approximately with experimental data. Heat transfer in jacketed agitated kettles of very viscous liquids is studied. The correlation for three agitators is plotted. Abstracts of five papers presented at the A.I. Ch. E. symposium on heat transfer are given. (D.E.B.)

773

ON SOME INTEGRALS OF GAS MOTION IN SINGLE DIMENSION. Yu. S. Zav'yalov (Tomskii Univ.). *Doklady Akad. Nauk S.S.S.R.* 103, 781-2(1955) Aug. 11. (In Russian)

774

ON THE EXAMPLE OF SUBSONIC GAS FLOW WITHIN THE RANGE OF SUPERSONIC VELOCITIES, LIMITED IN ITS DOWNWARD FLOW BY A SUDDEN INCREASE IN DENSITY, TERMINATING WITHIN THE FLOW. F. I. Frankl. *Priklad. Mat. i Mekhan.* S.S.S.R. 19, 385-92 (1955) July-Aug. (In Russian)

775

ON THE THEORY OF NON-LINEAR CONICAL FLOWS. B. M. Bulakh. *Priklad. Mat. i Mekhan.* S.S.S.R. 19, 393-409(1955) July-Aug. (In Russian)

Streamlining of conic shaped bodies partially projecting from the non-disturbed stream is investigated. Numerical calculations are given for the streamlining of sagittary wings with supersonic edges. (tr-auth)

Refer also to abstract 884.

MATERIALS TESTING

776 AERE-M/R-649

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CALIBRATION OF THERMOCOUPLES UNDER IR-RADIATION IN BEPO. P. E. Madsen. Jan. 25, 1951. 21p.

The thermo-electric emf of a chromel-alumel thermocouple at the freezing points of tin and lead and of iron-constantan, copper-constantan and platinum-platinum/13% rhodium thermocouples at the freezing point of lead have been measured in BEPO. Of the four couples investigated at the freezing point of lead, the platinum-platinum/13% rhodium couple gave the most reproducible behavior and no significant change in the couple reading was introduced by irradiation. The other couples all showed significant increases, chromel-alumel giving the biggest effect, i.e., 1.1°C. At the freezing point of tin, chromel-alumel showed no significant change at first but on prolonged irradiation gave a statistically significant decrease of 0.47°C. In all the couples, the mean of the readings when the pile was working was significantly different from when it was shut down, but this effect was small except for the chromel-alumel couple at 327°C when it was about 0.5°C. (auth)

777 ANL-4848

Argonne National Lab., Lemont, Ill.

THERMAL CYCLING EQUIPMENT. R. M. Mayfield and S. T. Zegler. No. 1, 1951. Decl. Apr. 5, 1955. 26p. Contract W-31-109-eng-38.

Three U cycling units have been designed and tested in regard to temperature range attainable, rate of cycling, and reliability of operation, and the results obtained were inter-compared. The units are an induction cycling unit, vertical tube cycling unit, and low-temperature cycling unit. (L.T.W.)

778 NACA-TN-3495

California. Univ., Los Angeles.

FAILURE OF MATERIALS UNDER COMBINED REPEATED STRESSES WITH SUPERIMPOSED STATIC STRESSES. George Sines. Nov. 1955. 69p.

A review of experiments on biaxial alternating stresses and simple combinations of static stress with alternating stress is shown to lead to a general criterion for the effect of static stress on the permissible amplitude of alternating stress. The proposed criterion is then shown to agree with results from tests that have been performed under more complex stress states. Tests were performed to determine the effect of static compression on alternating torsion, the one simple combination that had not been previously investigated. These results also agree with the criterion. It is shown that Orowan's theory of fatigue can be modified to predict the observed effect of mean stress on the permissible amplitude of alternating stress. (auth)

779 USNRDL-TR-60

Naval Radiological Defense Lab., San Francisco.

EFFECTS OF ELEVATED TEMPERATURES ON THE

PROPERTIES OF PORTLAND CEMENT MIXTURES RELATED TO SURFACE REMOVAL AND DECONTAMINATION. R. H. Heiskell, R. H. Black, R. J. Crew, and H. Lee. Aug. 25, 1955. 50p. Project NS-086-001.

Tests were conducted to obtain basic data on the effects of flame-treating concrete surfaces as an aid to the surface removal of radioactivity. Test samples and equipment are described, and data are presented from oven tests, flame-treating tests, and calcining tests. The results indicate that the flame-treating method of decontamination of concrete is less effective than decontamination afforded by sealing or protective coatings, pyrotechnic compositions, and chemical methods. Data are appended on the characteristics and control of the test ovens, the composition of the test samples, and test results. (C.H.)

780 WADC-TR-53-308(Pt.II)

Cincinnati. Univ.

DENSITY AND VISCOSITY OF MOLTEN MATERIALS. PART II. APPLICATION OF HOEPLER, ANDRADE, AND PIEZOELECTRIC CRYSTAL VISCOMETERS FOR VISCOSITY MEASUREMENT. [Period covered] January 1952–August 1953. Joseph W. Sausville. Feb. 1955. 59p. Project title: ANPP DEVELOPMENT SUPPORT PROJECT. Task title: VISCOSITY OF MOLTEN MATERIALS. Contract AF33(616)-52-9.

The development of a Hoepler, or rolling ball viscometer for use under a controlled atmosphere was extended to the point of calibrating the instrument over the temperature range 400 to 700°C using Na as the calibrating liquid. An Andrade viscometer was used in attempts to measure the viscosity of liquid NaOH. Development was started on a viscometer which uses a piezoelectric crystal cut for torsional vibration. The crystal is driven by an oscillator and is coupled with a rod to a viscous medium. Electronic components were built for measuring the resonant frequency and the resonant resistance of the damped crystal. A crystal housing and crucible were built for making viscosity measurements at high temperature. The characteristics of the crystal-probe rod combination were studied as a function of temperature and of viscosity. Considerable difficulty was met in stabilizing the electronic components of the system in the attempt to obtain high sensitivity with the instrument. (auth)

781 WAPD-76

Westinghouse Corp. Atomic Power Div., Pittsburgh. WAPD-1 EXPERIMENTS IN THE MATERIALS TESTING REACTOR. II. BELLWS—EXTENSOMETER TEST WAPD 1-2. George F. Mechlin. Mar. 12, 1953. Decl. Sept. 28, 1955. 25p. Contract AT-11-1-GEN-14.

Tests preliminary to the measurement of in-pile creep rate have been performed in the MTR. The behavior of two differential transformers and one slide wire extensometer has been evaluated. A He recirculation cooling system and a stainless steel bellows have been tested. Rapid failure of the differential transformers was observed. Results on the slide wire extensometer and the bellows are promising but acceptance must await further test. The He system has shown to be satisfactory in all respects. (auth)

782

NUCLEAR BLAST DESIGN. David L. Narver, Jr. Los Angeles and Washington, D. C., Holmes and Narver, Inc., [1955?]. 12p.

The effects of blast forces on structural walls and buildings are discussed. Factors affecting the path and

force of shock waves are discussed and diagrammed. In the case of nuclear explosions radioactivity and re-entry into a building that has withstood a blast are considered briefly. (C.H.)

Refer also to abstract 888.

PUMPS

783 NP-5818

[Allis-Chalmers Mfg. Co., Milwaukee].

ELECTRO-MAGNETIC CENTRIFUGAL LIQUID METAL PUMP. Revised Edition. R. Klecker. July 17, 1951. 29p.

The general description and theory of electromagnetic pumps are given. The forces existing in the pump and methods for their use in calculating pump performance are given in detail. Sample calculations for the performance of a given pump are worked out, and the accuracy of the calculations discussed. Design and manufacturing techniques, and improvements for pumps used in atomic installations are suggested. (D.E.B.)

WASTE DISPOSAL

Refer also to abstract 755.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

784 AD-40762

American Electro Metal Corp., Yonkers, N. Y.

INVESTIGATION OF THE EFFECT OF RAW MATERIAL PRODUCTION VARIABLES ON THE PHYSICAL AND CHEMICAL PROPERTIES OF CARBIDES, NITRIDES AND BORIDES. Progress Report No. 13 for the Period May 1 to June 30, 1954. H. Blumenthal. 37p. Project 51-6154-285 (17). Contract AF 33(616)-89.

In the course of this investigation on the effect of raw material production variables on the properties of titanium carbide, it has been found that despite the similarity of chemical analyses of different titanium carbide powders used as starting materials, the physical properties of finished pieces are different. A metallographic study, carried out during the report period, links physical properties to microstructures. It is shown that microstructure, grain shape and grain growth are functions of three inter-related factors; powder production procedure, surface condition of the particles, and impurities either contained in the original powder or acquired during ball milling. An explanation is offered for the "coring effect", long observed, but heretofore of unknown origin. The explanation is based on the assumption of an oxide film and on chemical analyses which materially substantiates these findings. (auth)

785 AD-59979

Armed Services Technical Information Agency Reference Center, Library of Congress, Washington, D. C. CERAMICS: A SELECTED REPORT BIBLIOGRAPHY. Feb. 1955. 122p. (ARC-1951)

A bibliography on ceramics consisting of catalog cards reproduced from the holdings of ASTIA and the Library of Congress is presented. (J.E.D.)

786 NP-5796

Alfred Univ., Alfred, N. Y.

FUNDAMENTAL PROPERTIES OF METAL-CERAMICS MIXTURES AT HIGH TEMPERATURES. Final Report [for] June 1, 1946-January 1, 1955. E. L. Swarts and W. B. Crandall. 104p. Project NR-032-022. Contract N6-ori-143.

A study was made to formulate from mixtures of metals and oxides new compositions for high-stress and high-temperature applications which might possess the more favorable characteristics of both classes of materials. The general problems of thermal diffusivity and shock, metal oxidation, and solid state diffusion are summarized. (auth)

787 UCRL-3135

California. Univ., Berkeley. Radiation Lab.

EPOXY RESIN CASTING OF DRY-TYPE HIGH-VOLTAGE TRANSFORMERS, BUSHINGS, AND POTHEADS. Charles W. Park. Jan. 13, 1955. 15p. Contract W-7405-eng-48.

Epoxy-cast components, which were used on electrical equipment to supply power to particle accelerators, are described. Included are figures of a current transformer which can be made in one pour of epoxy resin. Stages in the fabrication of the secondary of a filament transformer are described. A bushing made in one pour of epoxy resin, an epoxy type termination for cable, and the complete bushing for a cable pothead are also discussed. (B.J.H.)

788 WADC-TR-53-287

Ohio State Univ. Research Foundation, Columbus.

STUDY OF THE SYSTEMS $\text{TiC-SiC-B}_4\text{C}$ AND TiC-VC-ZrC . Oliver E. Accountius, Robert F. Stoops, Howard E. Konrad, Harold M. Greenhouse, and Clinton McBride. Mar. 1955. 200p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF 33(038)-16911.

The initial study of the density and oxidation resistance of 66 binary and ternary compositions in the system $\text{TiC-SiC-B}_4\text{C}$ is given. A dense oxidation-resistant area, attributed to the formation of a complex borosilicate glass, was found in the triaxial diagram. Characteristics of both hot-pressed and sintered compacts are investigated. The oxidation mechanism in two commercial mixed-carbide base cermets is studied. A hypothesis is presented to explain, and a parameter is derived to measure, the relative oxidation resistance of mixed carbides and carbide base cermets. The metal bonding of the most promising compositions suggested by the triaxial diagram are treated. Of special interest was the system $55.4 \text{ TiC} + 17.9 \text{ TiB}_2 + 10.0 \text{ Si} + 16.7 \text{ Co}$. Some of the physical properties of binary and ternary compositions in the system TiC-VC-ZrC are also investigated. (D.E.B.)

789 WADC-TR-54-33

Ohio State Univ. Research Foundation, Columbus.

PRELIMINARY MICROSCOPIC STUDIES OF CERMETS AT HIGH TEMPERATURES. [Period covered] September 1952 to September 1953. Earle T. Montgomery, Thomas S. Shevlin, Harold M. Greenhouse, and Herbert W. Newkirk. Apr. 1955. 40p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMETS

MATERIALS DEVELOPMENT. Contract AF 33(038)-16911.

The determination of some of the physical properties of cermet III B $55.4 \text{ TiC} + 17.9 \text{ TiB}_2 + 10.0 \text{ Si} + 16.7 \text{ Co}$ is considered. It also covers the design, construction, and testing of special equipment required for the study of the microstructure of TiC base cermets. The initial study of possible phase changes and changes in microstructure of some TiC base cermets, with time, at high temperatures is reported. A tentative theory is advanced in explanation of the steep slope of the stress-rupture curves for $\text{TiC} + \text{Ni}$ cermets of the type produced by Kennametal, Inc. In preparation for this study the following special equipment was built: a high-temperature x-ray camera, a vacuum quench furnace, and apparatus for the determination of coefficients of thermal conductivity at temperatures to 1700°F . This equipment is described in detail. A preliminary evaluation of the potentialities of TiB_2 and MoSi_2 as components of a cermet is discussed. (auth)

790 WADC-TR-54-38

New York. State Univ. Coll. of Ceramics, Alfred.

METAL AND SELF-BONDED SILICON CARBIDE. [Summary Report for] January 11, 1953 to JANUARY 10, 1954. R. A. Alliegro, L. B. Coffin, and J. R. Tinklepaugh. Jan. 1954. 65p. Contract AF33(038)-16190. (AD-50078)

Dense silicon carbide in the range of 95 to 97% of theoretical density was produced using various grain size mixes of alpha silicon carbide. When beta silicon carbide is used as the grain for hot pressing, uniform densities in the 97 to 98% range of theoretical density are obtained. Hot pressed silicon carbide bonded by Cr:Mo (1:1) has a strength of 31,000 psi, modulus of rupture. This material is relatively stable at high temperatures in air, carbon monoxide and steam. Silicon carbide structures having porosities in the 35 to 40% range may be infiltrated by Hastelloy C under pressure. Chromium-nickel alloys and titanium metal will bond silicon carbide when sintered in vacuum. (auth)

791 WADC-TR-54-414

New York. State Univ. Coll. of Ceramics, Alfred.

THE PRESSURE-CARBONIZATION OF CARBON BONDED SILICON CARBIDE-GRAPHITE FOR USE IN UNCOOLED ROCKET NOZZLES. Telephore L. Charland, James R. Tinklepaugh, and Bruce R. Goss. Apr. 1955. 21p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF 33(616)-2007.

The resistance to flame erosion of Alfred 410, a carbon bonded SiC -graphite composition, was improved by the substitution of larger grain sized SiC for the "settling tank fines" previously used. A new method of forming and firing carbon bonded SiC -graphite was developed in which the material was carbonized under pressure in stainless steel dies. The process resulted in a product with 15% higher density and 40% lower porosity than that previously obtained. This improvement in properties also resulted in greater resistance to flame erosion. (auth)

CORROSION

792 HW-36692

Hanford Atomic Products Operation, Richland, Wash.

THE CORROSION OF ALUMINUM AND ITS ALLOYS. C. Groot and R. M. Peekema. May 13, 1955. 36p. Contract W-31-109-Eng-52.

The corrosion rates for 26 different alloys of Al were determined from weight loss measurements. Of these alloys, only two, namely 24S and 99.995% Al + 0.04% V were screened from the lot because of significantly poorer corrosion resistance. The remaining alloys had essentially the same corrosion rate, which is 5.0 ± 2.6 mils/yr at 87°C and 21.5 ± 8.0 mils/yr at 120°C in water. The corrosion rate of Zr was so small as to be not measurable up to 90°C. Three additional Al alloys, Lurium 5, Lurium 10, and 99.95% Al, were screened from the other alloys because these three exhibited intergranular corrosion. (auth)

793

PROTECTION OF STAINLESS STEELS FROM CORROSION BY ANODIC POLARIZATION. N. D. Tomashov and G. P. Chernova. (Inst. of Physical Chemistry.). Doklady Akad. Nauk S.S.S.R. 104, 104-7(1955) Sept. 1. (In Russian)

Experiments with anodic polarization and weak current (from outside sources) applied as protection against corrosion of stainless steel in sulfuric acid gave positive results. (R.V.J.)

794

PHYSICO-CHEMICAL CONDITIONS OF DIFFUSION FILM FORMATION ON THE SURFACE OF IRON AND ITS ALLOYS. N. S. Gorbunov (Inst. of Physical Chemistry.) Izvest. Akad. Nauk S.S.S.R. No. 5, 793-9(1955) Sept.-Oct. (In Russian)

The process of diffusion film formation on iron and its alloys was studied with the groups and subgroups of Mendeleev's periodic system. The similarity of crystal lattices of the film element and iron, the comparatively smaller atomic diameter of diffusing elements, and the sufficient solubility of it in iron at room temperatures are the conditions causing the formation of diffusion films on iron and its alloys. (R.V.J.)

Refer also to abstracts 842, 863, and 887.

GEOLOGY AND MINERALOGY

795 NP-5795

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

DEVELOPMENT WORK ON LAPOINTE PICKER. G. G. Eichholz, G. E. Alexander, and A. H. Bettens. July 29, 1955. 19p. (TR-130/55)

A new Lapointe picker installation is described which was designed for routine concentration tests on a variety of ores. Two simplified electronic units were constructed, one using metal rectifiers and vacuum tubes, and the other completely transistorized. Various mechanical problems are outlined and some attempts to evolve a satisfactory feeder are described. (auth)

796 RME-51

Grand Junction Operations Office, AEC, Colo. RECONNAISSANCE OF THE CHINLE FORMATION IN THE CAMERON-ST. JOHNS AREA, COCONINO, NAVAJO, AND APACHE COUNTIES, ARIZONA. C. C. Gregg and E. L. Moore. Jan. 1955. 17p.

Selected literature pertaining to the Chinle outcrop between Cameron and St. Johns, Arizona, has been summarized, and an interpretation of the data made in order to delineate favorability criteria for uranium deposits. De-

tailed studies of two deposits are described. Studies revealed that the mineralized Chinle beds in Arizona cannot be correlated with those containing the uranium deposits in Utah. The nature of Ruth and Brigham deposits was investigated and a brief discussion is given. (auth)

797 RME-73

Grand Junction Operations Office, AEC, Colo. SUMMARY OF AIRBORNE RADIOMETRIC SURVEYING IN THE KAIPAROWITS PLATEAU AREA, KANE COUNTY, UTAH. G. E. Klosterman. July 20, 1954. 11p.

The Kaiparowits Plateau project was suspended, approximately one-third complete. Since the Morrison formation contains the only radioactive deposit within the project area, it is recommended that if the survey is continued the primary area considered should be in the vicinity of the only known radioactive deposit. It is believed that with completion of this area, which would amount to about one-third of the total area recommended, a better comprehension of the potentialities of the area as a whole might be gained. This in turn would limit the flying time to approximately 2.5 months instead of an estimated five months flying time for completion of a full coverage type program. (auth)

798 RME-75(Pt.1)

Grand Junction Operations Office, AEC, Colo. DRILLING AT DRIPPING SPRINGS, EMERY COUNTY, UTAH. David N. Hinckley, John H. Volgamore, and William J. Potter. Jan. 1955. 24p.

The diamond drilling project in the Dripping Springs area of the San Rafael Swell is reported. Two rigs drilled 14,472.9 ft in 212 holes. The three favorable areas in the Shinarump conglomerate upon which the drilling program was recommended were drilled. In addition, twenty wildcat holes, based on lithologic and structural trends, were drilled at various locations throughout the area. Geologic conditions favorable and not favorable to the occurrence of uranium deposits are discussed. (auth)

799 RME-76(Pt.1)

Grand Junction Operations Office, AEC, Colo. COLOR CHANGES AND URANIUM DEPOSITS OF THE UPPER MORRISON FORMATION NORTHEAST FLANK OF THE ZUNI UPLIFT, NEW MEXICO. T. A. Konigsmark. Jan. 5, 1955. 15p.

Known uranium deposits in the Morrison formation, McKinley County, New Mexico, occur in pale yellowish-brown or white sandstones in the Brushy Basin shale member and upper part of the dominantly reddish-brown Westwater Canyon sandstone member. These favorably colored sandstones occur as braided intraformational sandstone channels or lenses in the Brushy Basin shale member, "pinchouts" of Westwater Canyon sandstone in mudstone, and as zones in which the entire thickness of the Westwater Canyon sandstone changes from reddish-brown to yellowish-brown. Ground and air photograph observation show that the uranium deposits and favorably colored sandstone are localized in areas of more intense fracturing and faulting along the northeast flank of the Zuni uplift. The close relation between the favorably colored sandstone, uranium deposits, and mudstone in the Brushy Basin member, together with the localization of the uranium deposits and favorably colored sandstone in areas of more intense fracturing and faulting suggests an origin by laterally migrating solutions. (auth)

800 RME-77(Pt.1)

Grand Junction Operations Office, AEC, Colo.
RECONNAISSANCE OF THE NORTHWEST RIM OF THE COLORADO RIVER BASIN, WAYNE AND GARFIELD COUNTIES, UTAH. Robert C. Gerhard. Jan. 1955. 18p.

An examination was made of the Salt Wash and Mossback outcrops in a 1,000-square-mile area along the northwest rim of the Colorado River, Wayne and Garfield Counties, Utah. In the Little Rockies district, oxidized deposits of vanadium-uranium ore, associated chiefly with carbonized wood, logs, and plant fragments, occur in extremely small lenses in two horizons of the Salt Wash member of the Morrison formation. Because of the small lenticular nature of presently known orebodies, physical exploration in this district does not now appear to be economically feasible. In the Southern Green River Desert, uranium mineralization associated with carbon trash, asphaltite, and copper minerals occurs in the lower Mossback channel unit filling paleochannels cut into the Moenkopi formation. (auth)

801 RME-1059

Division of Raw Materials. Denver Exploration Branch, AEC.

RESULTS OF AN AIRBORNE RECONNAISSANCE FOR URANIUM IN SOUTHEASTERN AND SOUTH CENTRAL COLORADO. L. J. Brown and W. Easton. Apr. 7, 1955. 14p.

An aerial radiometric survey was made of three distinct physiographic areas in south central and southeastern Colorado. Tertiary, Cretaceous and Carboniferous sediments and Tertiary intrusives and volcanics were examined. Six areas of anomalous radioactivity were located, none of which appear to be associated with possible commercial uranium deposits. No favorable or promising horizons or areas were discovered. (auth)

802 RME-2021

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

SUMMARY OF AIRBORNE RECONNAISSANCE IN THE LITTLE ROCKY MOUNTAINS, MONTANA. Olin M. Hart and Earl Lovejoy. Decl. 1954. 10p.

The Little Rocky Mountains in northcentral Montana were radiometrically surveyed by airborne methods. A total of 93 hours and 50 minutes of flying was required to survey an area of 218 square miles and 90 linear miles of rim. The rock types flown were pre-Cambrian schists and injected gneisses, Paleozoic sediments, Tertiary intrusives. The results of the airborne radiometric survey and field investigations indicated no uranium mineralization of any significance in grade or size to be detectable from the surface by the equipment and procedure used. No further investigation of the area appears warranted at the present time. (auth)

803 RME-2027

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

AIRBORNE RECONNAISSANCE: WEST-CENTRAL UTAH PROJECT-1954. Robert J. Meehan and Neil S. Mallory. Feb. 1955. 11p.

An airborne reconnaissance survey was conducted in west-central Utah. Approximately 6,800 square miles were reconnoitered. No uranium mineralization was discovered. Known uranium occurrences and samples reputed to come from mines in the western part of the

area suggest that there may be uranium mineralization at depth which is not detectable by airborne methods. Although the very large eastern area was given sparse coverage, the consistency of the low background coupled with the lack of favorable horizons makes this area appear unfavorable for uranium mineralization. (auth)

804 RME-3113

Bureau of Mines and Geological Survey.

BUFFALO CREEK MONAZITE PLACER, CLEVELAND AND LINCOLN COUNTIES, NORTH CAROLINA. R. F. Griffith and W. C. Overstreet. Jan. 1953. 17p., 1 illus.

The flood plains upstream from the junction of Buffalo and Glen Creeks were recommended as one of three monazite placer deposits near Shelby, N. C., for investigation. The selection was influenced by past production from small tributary streams and the occurrence of known source rocks in this area. Seventeen churn-drill holes were completed to bedrock on 121 acres of this deposit for a total footage of 220 ft. The results of this program indicated over 2,000,000 yd³ of minable alluvium containing nearly 1,400 tons of monazite, 20,000 tons of garnet, 8,000 tons of ilmenite, 2,000 tons of kyanite, 1,000 tons of rutile, and 200 tons of zircon. The indicated tenor of 1.25 lb of monazite yd³ is not enough to support a successful mining operation on a deposit of this size under present economic conditions unless a market can be established for the other heavy minerals and the gravel contained in this deposit. The lower one-half of the deposit, composed of gravels and coarse sands, has an average monazite content six times that of the overlying finer-grained sediments, which contain on an average 0.35 lb of monazite yd³. The stripping of this overburden to expose the richer, underlying strata might prove to be an economical method of mining the deposit. (auth)

805 RME-3116

Bureau of Mines and Geological Survey.

MONZONITE PLACER ON THE FIRST BROAD RIVER AND ITS TRIBUTARIES, CLEVELAND COUNTY, NORTH CAROLINA. Leland A. Hansen and Norman P. Cuppels. July 1954. 27p.

The First Broad River placer, in Cleveland Co. in southwestern North Carolina, is a flood plain that extends 5.7 miles along the river and contains about 18 million yd³ of alluvium including about 8 million yd³ of contiguous sediments in tributary flood plains. Concentrations of monazite are irregularly distributed in the placer. The First Broad River drains 126 mi.² of monazite-bearing rocks upstream from the placer. Bedrock in the placer area is chiefly sillimanite schist and biotite schist of the Carolina gneiss, and locally small sills of Toluca quartz monzonite crop out in some of the tributary streams. Drilling results indicate the following averages: depth, 22 ft; black sand concentrates, 17.36 lb/yd³; monazite, 0.79 lb/yd³. A summary of the indicated reserves of the more important minerals is given. (auth)

806 RME-4054

Grand Junction Operations Office, AEC, Colo.

AIRBORNE RADIOMETRIC SURVEYING IN GRAND, SAN JUAN, EMERY, AND WAYNE COUNTIES, UTAH AND MONTROSE COUNTY, COLORADO. A. L. Nash. Oct. 3, 1953. 23p.

The results of airborne radiometric surveying in Grand, San Juan, Emery, and Wayne Co., Utah, and Montrose Co., Colo. are summarized. Five general geographic areas

were surveyed: Lisbon Valley area, Indian Creek area, Green River Desert-Cataract Canyon area, Inter-River area, and Skein Mesa area. Twenty-two areas of anomalous radioactivity were found. Probably the most significant result of the survey was the discovery of numerous anomalies in the Cutler formation in the Indian Creek area. (auth)

807

ABUNDANCE OF Sr^{87} DURING GEOLOGIC TIME. Paul W. Gast. *Bull. Geol. Soc. Amer.* 66, 1449-54(1955) Nov.

A method for dating marine carbonates and shells by measuring the Sr^{87} abundance found relative to that in surface rocks has been investigated. Any differences in the Sr^{87} abundance are too small to be measured accurately enough with present techniques. A large discrepancy was noted in predicted and measured Sr^{87} abundances. Certain factors which may account for these observations are discussed. (C.W.H.)

808

MINERALOGY OF URANIUM DEPOSITS, GOLDFIELDS, SASKATCHEWAN. S. C. Robinson. *Geol. Survey Can. Bull.* 31, 1955. 128p. (Available from Edmond Cloutier, Ottawa, Canada; \$0.75)

The results of an investigation of the nature and mode of occurrence of U-bearing minerals in the Goldfields region of northern Saskatchewan are reported. All U minerals recognized and other associated minerals are described and 48 microphotographs are included. The mode of occurrence of the minerals, rocks, and structures of the deposits are discussed, and emphasis is placed on data useful to prospectors and operators. Determinations of the age and history of the deposits, based on their Pb-U ratio are presented. New minerals known only from this region are described. (J.E.D.)

809

ABNORMAL RADIOACTIVITY IN THE HIGHER TRIAS OF THE VOSGES. Georges Jurain. *Compt. rend.* 241, 975-7 (1955) Oct. 10. (In French)

The study of the radioactivity of the lignites of the Keuper lorraine justifies a biogeochemical hypothesis to explain the origin of the uraniferous concentration in this region. (tr-auth)

810

GENESIS OF GRANITE PEGMATITES CONTAINING RARE METALS. K. A. Vlasov. *Izvest. Akad. Nauk S.S.S.R. Ser. Geol.* No. 5, 54-71(1955) Sept.-Oct. (In Russian)

811

DISTRIBUTION OF RARE EARTHS IN MONAZITES. E. E. Vainshtein, A. I. Tugarinov, and N. V. Turans'kaya (Vernadskii Inst. of Geochemistry and Analytical Chemistry). *Doklady Akad. Nauk S.S.S.R.* 104, 268-71(1955) Sept. 11. (In Russian)

X-ray-spectral analysis was made on monazites of various genesis and regions. In all experiments with changes in rare earth distribution in the mineral, the consistent decrease in relative contents of La and Ce and simultaneous increase of Sm or the reverse case of increase in La and Ce with decrease of Sm was observed. A detailed table of La/Nd, Cl/Nd, Sm/Nd, Gd/Nd, and Pr/Nd distribution in monazites by districts is presented. (R.V.J.)

812

GEOLOGY OF THE FLAMING GORGE QUADRANGLE, UTAH-WYOMING. GEOLOGIC QUADRANGLE MAP

GQ-75. Wallace R. Hansen. Washington, U. S. Geological Survey, 1955.

The geologic map of the Flaming Gorge Quadrangle is part of a detailed study of the geology along the main stem of the upper Green river in Utah. The map covers the faulted areas in Red canyon, the adjoining uplands, and the area east of the Green river between Chokecherry Draw and the Wyoming state line. (auth)

813

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-6 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-101. C. F. Miller. Washington, U. S. Geological Survey, 1955. \$0.50.

814

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-7 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-102. W. H. Condon and C. F. Miller. Washington, U. S. Geological Survey, 1955. \$0.50.

815

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-9 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-103. J. T. Cass. Washington, U. S. Geological Survey, 1955. \$0.50.

816

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-10 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-104. W. H. Condon. Washington, U. S. Geological Survey, 1955. \$0.50.

817

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-11 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-105. B. H. Kent. Washington, U. S. Geological Survey, 1955. \$0.50.

818

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-12 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-106. C. F. Miller. Washington, U. S. Geological Survey, 1955. \$0.50.

819

PHOTOGEOLOGIC MAP OF THE MOAB-11 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-107. C. E. Bates. Washington, U. S. Geological Survey, 1955. \$0.50.

820

PHOTOGEOLOGIC MAP OF THE TIDWELL-6 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-108. H. S. Bennett. Washington, U. S. Geological Survey, 1955. \$0.50.

821

IS CARBON DIOXIDE AN ORE-FORMING FLUID UNDER SHALLOW-EARTH CONDITIONS? R. M. Garrels and D. H. Richter. *Econ. Geol.* 50, 447-58(1955) Aug.

A review of some of the physical-chemical properties of CO_2 and of the system CO_2 - H_2O indicates that under some shallow-earth conditions CO_2 can exist as a separate phase with a density approximately that of water. The

effect of dissolved neutral or acid salts on the solubility of CO_2 in H_2O is not large. Carbonates, oxides, and silicates, through reactions with a CO_2 -saturated water phase, will eventually cause the disappearance of a CO_2 phase. The prevalence of CO_2 in the earth's crust is attested by its abundance in natural gases and fluid inclusions in minerals. Some of the characteristics of uranium ores of the Colorado Plateau are not incompatible with the assumption that deposition was from a fluid CO_2 phase. (auth)

Refer also to abstract 937.

METALS AND METALLURGY

822 A-4045

[Iowa State Coll., Ames. Inst. for Atomic Research]. DEVELOPMENTS IN THE CASTING DEPARTMENT OF THE METAL PRODUCTION PLANT AT IOWA STATE COLLEGE. Special Report on THE CASTING OF URANIUM AT IOWA STATE COLLEGE. H. A. Wilhelm. Aug. 25, 1945. Decl. July 28, 1955. 17p. Contract W-7405-eng-82.

The method of U rod casting at ISC is described. Imperfections that have been experienced are listed and possible remedies suggested. (D.E.B.)

823 AD-35659

Kentucky. Univ., Lexington. Kentucky Research Foundation.

SCALING OF TITANIUM AND TITANIUM ALLOYS. Progress Report No. 8 [for] January 1, 1954 to April 1, 1954. H. J. Siegel. 4p. Contract AF18(600)-60.

Arc melting of 12 of the alloys to be investigated was completed; 8 of these alloys were fabricated. A tabulation is shown of the alloys expected to be investigated, and the number of melting operations required to obtain radio-graphic homogeneity of those alloys which were completed. (auth)

824 AD-37740

National Research Corp., Cambridge, Mass.

HIGH PURITY NICKEL PROJECT. Final Report. Stanwood R. Williams and Philip J. Clough. Mar. 29, 1954. 43p. For Raytheon Manufacturing Co. Contract NObsr-63058, Sub Task 10.

This report contains appendices A through D, identified as AD-37740-A; AD-37740-B; AD-37740-C; and AD-37740-D, respectively.

825 AD-39838

Battelle Memorial Inst., Columbus, Ohio.

SPOT-WELDED JOINTS IN TITANIUM ALLOYS AND THEIR BEHAVIOR IN FATIGUE. Progress report [for the period May 10 to July 10, 1954]. W. H. Kearns and W. S. Hyler. July 10, 1954. 46p. Contract AF33(616)-2005.

Tension-shear and cross-tension tests were made of single spot welds in commercially pure Ti sheet. The strength of individual spot welds in 6-spot specimens was studied, together with the fabrication of unalloyed sponge-Ti sheet. The results of fatigue tests on welds in 7% Mn-Ti alloy sheets are reported. A study was made in order to determine the mode of failure of the joints. The results of fabrication of experimental Ti alloy sheet are reported. Preliminary investigations of tension-shear and

cross-tension tests on spot welds in stainless steel are given. (B.J.H.)

826 AD-41197

Allegheny Ludlum Steel Corp. Research Dept., Watervliet, N. Y.

DEVELOPMENT OF WROUGHT AND CAST ALLOYS FOR HIGH-TEMPERATURE APPLICATIONS. Progress Report No. 1 for April 1, 1954 to June 30, 1954. R. R. MacFarlane, R. S. DeFries, E. E. Reynolds, and W. W. Dyrkacz. July 15, 1954. 34p. Contract AF33(616)-2463.

Investigations have been initiated on the influence of composition modifications on the rupture, tensile, and thermal shock properties of wrought Fe-base austenitic Mn-Cr alloys and wrought and cast Co-base alloys. (C.W.H.)

827 AD-59789

Climax Molybdenum Co. of Michigan, Detroit.

OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM. Final Report for the Period October 2, 1952-February 28, 1954. 65p. Contract AF 33(038)-16197.

Nine single-layer coating compositions applied in thicknesses of approximately 0.010 in. were found to have the capacity to protect Mo from oxidation in air at 1700°F or 1800°F for 500 hrs. Seven of the coatings were flame-sprayed onto Mo specimens as powder mixtures of Al and alloys containing Si. The other two flame-sprayed coatings were Ni-Cr-B alloys. Two of the most promising single-layer compositions (20% Al plus 80% Cr-Si alloy) and one without Al were subjected to additional tests. Data are compared with tests on a previously-developed three-layer coating containing Cr-Si alloy. (See also AD-15186 and AD-15190.) (C.H.)

828 AD-66412

Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation.

EXTRUSION OF ALUMINUM ALLOYS. Period covered: August 31, 1954 to April 30, 1955. Walter A. Backofen. 86p. Contract DA-19-020-ORD-3454.

Progress is summarized from a study of the mechanical-metallurgical aspects of cold extrusion of Al alloys. Equipment design and testing procedures are described. Data are included from an evaluation of the strain-hardening characteristics of the 7075-0 alloy selected for the extrusion experiments. Previous work in the field is reviewed. 42 references. (C.H.)

829 AECD-3688

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EVALUATION OF A MODIFIED ZIRCALOY-2 INGOT F-1071 MELTED AT WAPD. J. G. Goodwin. Apr. 14, 1954. Decl. with deletion Oct. 24, 1955. 3p.

A modified Zircaloy-2 ingot melted by the nonconsumable electrode melting technique was tested for hardness, composition, mechanical properties, and corrosion. Modified Zircaloy 2 is composed of 0.5% Sn, 0.1% Fe, 0.1% Cr, 0.05% Ni, and sponge Zr. In general, test results were similar to those for Zircaloy 2. (M.P.G.)

830 AERE-M/M-99

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ETCHANT FOR NIOBIUM METAL. O. Flint. July 1955. 5p.

An etchant which reveals the grain structure of niobium is described. (auth)

831 BMI-779

Battelle Memorial Inst., Columbus, Ohio.
TENSILE-CREEP PROPERTIES AT 500 F OF ZIRCONIUM AND A 3.66 PER CENT URANIUM ALLOY OF ZIRCONIUM. A. D. Schwoppe and G. T. Muehlenkamp. Nov. 1, 1952. Decl. Aug. 30, 1955. 18p. Contract W-7405-eng-92.

No directional effects were observed in annealed Zr when creep tested at 500°F. Increasing the stress from 10,000 to 16,000 psi increased the total deformation at 2000 hrs from 0.31 to 5.7% and the secondary creep rate from 0.3×10^{-4} to 3.0×10^{-4} %/hr. For the Zr-3.66% U alloy, the effect of increasing the stress from 20,000 psi to 30,000 psi was to increase total deformation at 2000 hrs from 0.39 to 5.25%, whereas the secondary creep rate increased from 7×10^{-6} %/hr at 20,000 psi to 10×10^{-6} %/hr at 22,000 psi. Above 22,000 psi, the creep rate was nil. (auth)

832 BMI-784

Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL AND METALLURGICAL PROPERTIES OF THORIUM. A. D. Schwoppe, G. T. Muehlenkamp, and L. L. Marsh. Nov. 18, 1952. Decl. Aug. 31, 1955. 35p. Contract W-7405-eng-92.

The basic mechanical properties of Th have been determined in tension and compression at room and elevated temperatures. Ames Th has been found to work harden very rapidly, to be strain-rate sensitive at room temperature, and to exhibit a tensile yield point at high strain rates in the annealed condition. The yield point was eliminated at a test temperature of 400°C at a strain rate of 0.659 sec^{-1} and at lower temperatures with slower strain rates. Th is also dimensionally stable under thermal-cycling conditions which are known to cause distortion in U. The hot hardness of Th has been determined as well as the dynamic moduli in bending and shear. Data are also reported describing the fatigue characteristics at room temperature. The notched-bar impact properties as a function of temperature are reported, and a transition from relatively low to high energy absorption was found in Ames Th between the temperatures of 100 and 200°C. (auth)

833 BMI-987

Battelle Memorial Inst., Columbus, Ohio.
A HIGH STRENGTH ZIRCONIUM ALLOY: ZIRCONIUM -4 w/o TIN -1.6 w/o MOLYBDENUM. W. Chubb, G. T. Muehlenkamp, and G. K. Manning. Mar. 18, 1955. 26p. Contract W-7405-eng-92.

A heat-treatable, ternary alloy of zirconium is described. This alloy is readily rolled at 800°C and has more than four times the creep strength of pure zirconium at 500°C. The tensile strength of the alloy in the annealed condition is about 90,000 psi, and it may be heat-treated to a strength of more than 140,000 psi. In the annealed condition, the alloy can be cold reduced more than 20%. The alloy is harder in the air-quenched condition than as water quenched. This behavior was found to be associated with a reaction similar to age hardening. It is suggested that, when β zirconium decomposes by the martensite shear mechanism, only moderate hardening occurs; when beta zirconium decomposes by chemical decomposition, additional hardening is observed, and the reaction proceeds in the manner of a precipitation-hardening process. In the

annealed condition, the strength of the alloy is insensitive to minor compositional changes. However, the heat-treatment response of the alloy changes rapidly with molybdenum content; decreasing the amount of molybdenum decreases the stability of the beta phase and decreases the strength and increases the ductility of the heat-treated alloy. (auth)

834 BMI-1017

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF WROUGHT IRON-CHROMIUM-ALUMINUM ALLOYS CONTAINING PLATINUM AND PALLADIUM. Henry A. Saller, John T. Stacy, and Stanley W. Porembka. July 12, 1955. 20p. Contract W-7405-eng-92.

The addition of small amounts of Pt and Pa to an Fe-25 w/o Cr-5 w/o Al alloy increased the oxidation resistance slightly at 2200°F and increased the short-time stress-rupture strength slightly at 1800 and 2200°F. Of the alloys considered, the alloy containing 10 w/o Pa appeared to have the best combination of these properties. The short-time stress-rupture strength of the 10 w/o Pa alloy was twice that of the base ternary alloy at 1800°F and three times that of the base alloy at 2200°F. At 2200°F, the 10 w/o Pa addition tripled the 100-hr rupture strength of the ternary-base alloy. Quinary additions of 2.5 w/o Nb, Mo, Ta, and W, respectively, had varying effects on the creep-rupture properties of the 10 w/o Pa alloy. Ta and W slightly increased the creep strength at 1800°F, but at 2200°F they decreased the strength slightly. Nb and Mo yielded alloys which were weaker than the quaternary alloy at both 1800 and 2200°F. (auth)

835 CAL-KA-797-M-10

Cornell Aeronautical Lab., Inc., Buffalo.
DEVELOPMENT OF SUBSTITUTE ALLOYS FOR HIGH TEMPERATURE USE. Bimonthly Progress Report. J. Salvaggi and G. J. Guarnieri. Apr. 30, 1954. 15p. Contract NOa(s)-52-368-c. (AD-37474)

Creep studies of three 30-lb heats, with compositions based on the 3 most promising alloys previously developed, are being conducted at 1500°F following initial solution treatment at 2300°F. Spot checks indicated a slightly higher solution temperature of 2350°F as necessary to equal maximum 100-hr rupture strengths previously reported for the 1500°F test temperature. Stress-rupture tests at 1500°F of a type 316 stainless steel with 0.15% C and Ni variations of 12, 15, and 20% indicated that there was no advantage in raising the Ni content of the steels above 12% for material solution-treated at 2300°F. The effect of Al addition on the 100-hr rupture strength of a 17 Cr-12 Ni 2.5 Mo-0.15 C-0.80 Ti stainless steel, solution-treated at 2100 and 2300°F, was considered. No advantage was evident in adding Al in amounts up to 0.41% to this steel for solution temperatures of 2100 and 2300°F. (auth)

836 CT-3522

[Massachusetts Inst. of Tech., Cambridge. Metallurgical Project].

PROGRESS (A-1) REPORT FOR MONTH OF APRIL 1946. May 18, 1946. Decl. Sept. 30, 1955. 15p. Contract W-7405-eng-175.

A number of beryllium rods and flats were made by extrusion. Attempts at making tubing were a failure, however. The recrystallization of forged and extruded Be is being studied. Solid solution alloys of Be with Cu or Ni

gave tensile strengths as high as 60,000 psi., but the ductility was less than that of pure Be. Work on alloys of U with Be and Fe with Be is still in progress. Specimens of distilled Be and Be made by the Zr reduction process have been extruded and will be tensile tested for comparison with ordinary Be. (auth)

837 CT-3718

[Massachusetts Inst. of Tech., Cambridge. Metallurgical Project].

PROGRESS (A-1) REPORT FOR THE MONTH OF OCTOBER 1946. Nov. 14, 1946. Decl. Sept. 30, 1955. 7p. Contract W-7405-eng-175. (M-3832)

The tensile testing of Be at elevated temperatures was continued. Attempts were made to extrude Be tubing on graphite and on steel cores. The solubility of U in Al and in Bi has been determined at temperatures up to 900°C. (C.W.H.)

838 HW-38079

Hanford Atomic Products Operation, Richland, Wash. THE EFFECT OF IRRADIATION ON THE MECHANICAL PROPERTIES OF ARC MELTED BUREAU OF MINES ZIRCONIUM WITH VARIOUS DEGREES OF COLD WORK. R. S. Kemper, Jr. and W. S. Kelly. July 29, 1955. 32p. Contract W-31-109-Eng-52.

Data are presented to show the effects of cold-working and subsequent neutron irradiation on the tensile properties and hardness of arc-melted Bureau of Mines Zr. Material in six initial states, annealed, and with 10, 20, 30, 40, and 50% reduction in area by cold swaging, was irradiated at 50 to 60°C (120 to 140°F) to integrated thermal flux levels of approximately 5.7×10^{19} , 1.5×10^{20} , and 2.4×10^{20} nvt. The results of post-irradiation vacuum annealing at 250, 300, and 350°C (480, 575 and 660°F) of tensile specimens are given. Increases in hardness and yield strength resulting from the irradiation were more pronounced in the annealed material and were progressively less at increasing levels of cold work. More uniform increases in ultimate strength and decreases in ductility were found. The radiation damage observed in the mechanical properties was essentially saturated at the exposure levels investigated. Slight annealing of radiation induced increases in yield strength occurred in 100 hours at 250°C (480°F) and approximately 70% of the radiation damage was removed in 160 hours at 350°C (660°F). Recovery of the radiation damage in annealed, irradiated material was greater than recovery of strain hardening in 50% cold-worked, unirradiated material for the same annealing conditions. (auth)

839 IDO-14352

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ELECTRODECONTAMINATION OF METALS. John B. Huff. Aug. 24, 1955. 22p. Contract AT(10-1)-205.

A description of a decontamination process for metals now in use at the Idaho Chemical Processing Plant is presented. Suggestions are offered to the designer for electrode-contamination. (auth)

840 ISC-545

Ames Lab., Ames, Iowa.

THORIUM-COLUMBIUM AND THORIUM-TITANIUM ALLOY SYSTEMS. O. N. Carlson, J. M. Dickinson, H. E. Lunt, and H. A. Wilhelm. [Nov. 22, 1954]. 20p. Contract W-7405-eng-82].

On the basis of data obtained from microscopic examination, melting observations, cooling curves, x-ray analyses and resistance measurements, phase diagrams have been proposed for the Th-Nb and Th-Ti alloy systems. Both are simple eutectic systems and have no terminal solid solubility of intermediate phases. The eutectic between thorium and niobium occurs at a composition of about 8 wt % Nb and a temperature of 1435°C. The thorium-rich liquidus has been determined from solubility experiments. High temperature x-ray studies and electrical resistivity curves indicate that the addition of Nb lowers the temperature of the thorium transformation slightly. The eutectic between thorium and titanium occurs at 1190°C at the composition 12 wt % Ti. Both the Th and Ti liquidus curves have been determined experimentally. The α - β transformation temperature of Ti is unchanged in the Th-Ti alloys. No experimental evidence was obtained on the effect of Ti upon the Th transformation temperature. (auth)

841 LWS-12085

California Research and Development Co., Livermore, Calif.

DETERMINATION OF STRENGTH, DUCTILITY AND IMPACT RESISTANCE OF BISMUTH AT 64°F TO 350°F. J. R. Cunningham. June 28, 1951. Decl. Apr. 12, 1955. 10p. Contract AT(11-1)-74.

Results of bend testing of simple Bi beams and impact testing of un-notched Charpy bars show that the ductility of Bi increases as the temperature is increased. Additions of Al did not decrease the ductility of Bi noticeably. The loads which cause a creep rate of 0.001 in/min in Bi at various temperatures are tabulated. (C.W.H.)

842 NBTL-T-R-89

Naval Boiler and Turbine Lab., Philadelphia.

EVALUATION OF HEAT AND SLAG RESISTANT PROPERTIES OF DIFFUSION ALLOY COATING. Test Conducted: August 1952-May 1953. 6p. (AD-41565)

A chromium alloy coating, applied to type 304 alloy steel was found to impart to the base metal slight but negligible protection against oxidation and corrosion by synthetic fuel oil ash at 1700°F. (NBTL abst.)

843 NP-5798

Massachusetts Inst. of Tech., Cambridge.

X-RAY STUDIES OF ORDER-DISORDER IN ALLOYS.

B. E. Warren. [1954?] 18p. Project [NR-031-282]. Contract [N5-ori-78/XXXII].

Investigations of order-disorder in alloys involve the measurement of short range order and long range order parameters as a function of temperature, determination of the physical states, mapping the two phase boundaries, measurement of the kinetics of the changes, determination of the ordering forces, and development of adequate theories of ordering. The structures of several Cu alloys are reviewed. (C.W.H.)

844 NP-5802

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS AND CONTROL OF HYDROGEN IN TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report No. 1. G. A. Lenning, L. W. Berger, W. M. Albrecht, C. B. Griffith, M. W. Mallett, D. N. Williams, and R. I. Jaffee. June 15, 1955. 23p. Contract AF 33(616)-2813.

The possibility that hydrogen embrittlement is associated with moisture-induced stress corrosion was investigated. The results indicated that moisture did not affect either time to failure or ductility in stress-rupture tests. In order to determine the origin of hydrogen embrittlement, microexamination of a number of fractured tensile specimens showing hydrogen embrittlement was made. In all cases the structure was too fine to show the path of fracture. Ti-140A alloy material, which showed hydrogen embrittlement in tensile tests with round specimens, failed to show embrittlement when tested in sheet form with a coarse alpha-beta structure. Alloy-preparation and -testing procedures for the study of the effect of alloy composition on the tendency to hydrogen embrittlement are described. Microstructural conditions and heat treatments to be investigated for the effect of microstructure on the tendency to hydrogen embrittlement are discussed. In the investigation of the removal of hydrogen by vacuum annealing, the study of high-purity titanium has been completed. The diffusion rate of hydrogen in alpha titanium has been determined between 600 and 800°C by outgassing. Below 650°C the diffusion rate decreased markedly. The diffusion in beta titanium was also determined at 900 and 1020°C by the outgassing method. The effect of hydrogen content on the rate of hydrogen removal between 100 and 600 ppm at 100°C was also investigated. The rate of hydrogen removal (fraction removed/fraction remaining) was independent of hydrogen content for the composition range investigated. The presence of an oxide film was shown to retard the rate of hydrogen removal in vacuum annealing. (auth)

845 NP-5810

Sandia Corp., Albuquerque, N. Mex.

A STUDY OF GAS POROSITY IN ALUMINUM CASTING ALLOYS USING RADIOACTIVE HYDROGEN AS A TRACER. Technical Memorandum 136-55-16. Osborne Milton. June 27, 1955. 24p.

A method will be described wherein the absorption of H by Al is evaluated using H^3 as a tracer element. Results show that H gas is readily absorbed into the melt when it is injected directly, but is not taken on from the combustion products, that quantities of it are released when the metal freezes, and that the commonly used methods of fluxing with chlorine and nitrogen gas are of value for degassing. (auth)

846 NP-5812

California. Univ., Berkeley. Inst. of Engineering Research.

CREEP OF SINGLE CRYSTALS AND POLYCRYSTALS OF ALUMINUM, LEAD AND TIN. C. D. Wiseman, O. D. Sherby, and J. E. Dorn. Nov. 1, 1955. 21p. Project NR-031-048. Task Order 11. Contract N7-onr-295, Technical Report No. 43.

Elevated-temperature creep tests were performed on single crystals and polycrystals of Al, Pb, and Sn under constant tensile stress as a function of temperature. Analyses of the results revealed that the activation energies for creep of the polycrystals equal the respective activation energies for creep of single crystals. For Al, and Pb, the activation energies for creep were found equal to the respective activation energies for volume diffusion suggesting evidence for a dislocation climb model for high-temperature creep. (auth)

847 NP-5813

Mine Safety Appliances Co., Callery, Penna.

MOLTEN METAL-WATER REACTIONS. Technical

Report No. 44. W. Milich and E. C. King. Nov. 9, 1955. 15p. Contract NObs-65426.

The reactions of water with molten Zr, Al, stainless steel, and steel in A and steam atmospheres and under high pressures have been investigated. No detonation or violent reaction was observed. (C.W.H.)

848 NP-5820

New York Univ., New York. Coll. of Engineering.

EFFECT OF TEMPERATURE AND STRAIN RATE UPON THE MECHANISM OF PLASTIC DEFORMATION IN ALPHA TITANIUM. Final Report. Y. C. Liu. May 30, 1955. 36p. Contract DA-30-069-ORD-1288.

A study was made of the deformation mechanism in large-grained α titanium specimens under high strain rate at various temperatures. Thirteen specimens were deformed by compressive impact at a velocity of 83.5 in./sec at three temperatures: -196°C, room temperature and 300°C. Deformation markings after impact were analyzed and a model of twinning was developed to fit the experimental data. Twinning was observed to be the predominant flow mechanism at all testing temperatures. Only three out of the five twinning systems reported for alpha titanium were observed to be operative. An orientation relationship between stress axis and operative twinning habits is presented. (auth)

849 NRL-4597

Naval Research Lab., Washington, D. C.

HOT CRACKING OF STAINLESS STEEL WELDMENTS. P. P. Puzak, W. R. Applett, and W. S. Pellini. July 12, 1955. 19p.

Various heats and forgings of type 347 and type 304 stainless steels were investigated with the aim of establishing the mechanism of weld- and base-metal hot cracking. It is deduced that hot cracking of the base metal results from the liquation of fusible segregates located at the boundaries of grains which adjoin the fusion line of the weld proper. The base-metal cracks develop high strain concentrations in the solidifying weld metal and, consequently, the cracks extend into the weld metal. If the weld-metal is not susceptible to hot cracking, by virtue of the presence of primary ferrite, the notch extension mechanism is inoperative. Thus, fusible grain boundary segregates establish the basic condition for base-metal cracking and for a severe testing of the ability of the weld-metal to resist hot cracking. Large grain size aggravates the segregate problem and, therefore, the weld cracking problem. The presence of weld- or base-metal cracks provides for low ductility stress rupture failures during the heat treatment or elevated temperature service of weldments subjected to yield point loading. Small cracks which are not visible except at high magnification may serve to initiate low ductility, stress rupture failures. The anomalous occurrence of long cracks in ductile material, after heat treatment of weldments judged to be crack-free prior to heat treatment, is explained by these findings. (auth)

850 NRL-4623

Naval Research Lab., Washington, D. C.

X-RAY-DIFFRACTION STUDIES OF THE BAINITE TRANSFORMATION IN FOUR ALLOY STEELS. L. S. Birks and R. T. Seal. Aug. 22, 1955. 12p. Project NR-694-040.

High-temperature x-ray-diffraction techniques were used to study and compare the isothermal and continuous-cooling bainite transformations in four alloy steels. With

short (3 sec) austenitizing time, the transformation to bainite was more rapid the lower the austenitizing temperature for a steel without boron but a possible reverse effect was observed in a steel containing boron. For predicting continuous-cooling transformation from isothermal diagrams, a rapid, graphical solution of the Scheil approximation is described in which the isothermal diagram itself is used as one scale of slide rule. (See also NRL-4564.) (auth)

851 NYO-1516

New York Operations Office, AEC.

RECOMMENDED PRACTICES FOR URANIUM FINISHING. William B. Harris. May 17, 1951. Classification changed from OFFICIAL USE ONLY May 31, 1955. 15p.

Because of its pyrophoricity and moderate toxicity, U requires special consideration in machine shops. Specific machining practices consistent with the maintenance of acceptable levels of airborne U are presented. These include various tools for each type of machining job with recommended tool speeds, coolant flows, and ventilation requirements. (auth)

852 OSR-TR-55-23

Cornell Univ., Ithaca, N. Y.

THE USE OF THE FIELD EMISSION MICROSCOPE FOR THE INVESTIGATION OF SURFACE CONDITIONS ON AN ALLOY OF MOLYBDENUM AND ZIRCONIUM: Technical Report No. 3 [on] THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE ATOMIC PHENOMENA OCCURRING ON AND NEAR THE SURFACES OF SOLIDS. L. Arthur D'Asaro. Sept. 1, 1955. 155p. Project No. R-355-30-4. Contract AF18(600)-674.

853 55-RL-1260

General Electric Co. Research Lab., Schenectady, N. Y. ARC MELTING IN HIGH VACUUM. P. C. Rossin. Mar. 1955. 17p.

Arc melting in high vacuum (<1 mm) requires a more rigorous balance of component sizes and power than melting in inert gases. The factors associated with arc stability and control, and their influence on the melting practice are discussed. A qualitative analysis of the thermal equilibrium associated with the cathode, arc column, anode, and mold-metal interface is presented. (auth)

854 SEP-184

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

NONDESTRUCTIVE DETERMINATION OF GRAIN SIZE IN METALS. Nicholas Grossman. August 1955. 31p. Contract AT-30-1-GEN-366.

Current methods of grain size determination are described: optical, X-ray, ultrasonic, and eddy current. The technical and economical significance of nondestructive testing is considered. The ultrasonic methods explored are: through transmission and pulse technique; amplitude decay, and back reflections counting. An explanation is given of the underlying principles. The results obtained on brass, steel, and zirconium are described. Generalizations of the test methods extend to metals with body-centered cubic, face-centered cubic, and hexagonal close-packed structures. The effects of certain concomitant factors, like grain shape and pearlite distribution in steel, are briefly explored. All tests are confined to metals with homogeneous structures. The work indicates that ultrasonics can be used to determine the grain size of metals nondestructively. (auth)

855 TID-5117

[Metallurgy Development Advisory Committee, AEC]. METALLOGRAPHY OF THORIUM: NOTES FROM THE FIFTH METALLOGRAPHIC CONFERENCE [HELD AT] WESTINGHOUSE ATOMIC POWER DIVISION. R. J. Gray and M. J. Feldman. Feb. 14, 1952. Decl. Apr. 18, 1955. 29p.

The various techniques used at Argonne National Lab., Ames Lab., Battelle Memorial Inst., Knolls Atomic Power Lab., Massachusetts Inst. of Tech., Oak Ridge National Lab., Sylvania Electric Products Inc., and Westinghouse Atomic Power Div. to grind, polish, and etch Th metal for metallographic examination are surveyed. Representative photomicrographs and 44 figures are shown. (G.Y.)

856 TML-7

Battelle Memorial Inst., Columbus, Ohio. Titanium Metallurgical Lab.

SURVEY OF THE PROBLEM OF DELAYED CRACKING IN FORMED TITANIUM PARTS. R. I. Jaffee and D. J. Maykuth. June 20, 1955. 53p. Contract AF18(600)-1375.

Delayed cracking in F-100 titanium alloys is a manifestation of hydrogen embrittlement which caused trouble with titanium-alloy forgings in compressors. Control of hydrogen to less than 150 ppm in future titanium-alloy sheet (8Mn) appears to be a good means of controlling delayed cracking in the future. (auth)

857 TML-18

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

ANALYSIS AND LABORATORY EXAMINATION OF AIRCRAFT PARTS WHICH FAILED BY DELAYED CRACKING. H. A. Robinson and P. D. Frost. Oct. 17, 1955. 28p. Contract AF 18(600)-1375.

Forty-eight parts formed from Ti-8Mn sheet were submitted by four airframe fabricators. All parts had failed, presumably by delayed cracking, in or near high-stress areas, such as bends, dimples, and surface flaws. These parts were given an exhaustive examination to determine the cause of failure. With one exception, the parts contained enough hydrogen to explain the failure as strain aging in regions of high stress. However, other factors, notably manganese content, microscopic and macroscopic structural defects, and degree of stress relief, were found to correlate with failures in such a way as to indicate a strong influence on the failures. If it is found that the present specifications for limiting hydrogen content do not control delayed cracking, the need for a more thorough study of these other factors will be indicated. (auth)

858 USBM-U-42

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD MARCH 15-JUNE 15, 1955. July 28, 1955. Changed from OFFICIAL USE ONLY Oct. 26, 1955. 44p. Contract AT-(11-1)-140.

The results of 155 Kroll process reduction runs using lined reduction crucibles are summarized. There was no noticeable difference in the oxygen content of zirconium sponge prepared with purified magnesium or changes in the air exposure conditioning techniques. Further investigations on treatment of Zircaloy 2 scrap indicate that under proper conditions, molten calcium appears to be more effective than vaporous calcium as a deoxidant. The present status of studies involving the mechanism of

metallic arc is presented. Hot water corrosion data show that Hf-Ti alloys containing over 50 wt.% titanium have decreasing corrosion resistance. First results of heat treated Zr-Ti and Zr-Fe alloys are shown. (auth)

859 USBM-U-57

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JUNE 15-SEPTEMBER 15, 1955. Oct. 10, 1955. Changed from OFFICIAL USE ONLY Oct. 26, 1955. 41p. Contract AT-(11-1)-140.

Studies were continued on the production of hafnium and low-O₂ zirconium. The feasibility of casting Zr was investigated. Hot water corrosion data are presented for Zr, Hf, Zr-Sn, Ti-Zr, Fe-Zr, and Hf-Ti alloys. (For preceding period see USBM-U-42.) (C.W.H.)

860 WADC-TR-54-45

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

COMPOSITE SPECTROPHOTOMETRIC PROCEDURES FOR THE ANALYSIS OF LOW-ALLOY STEELS AND OF ALUMINUM ALLOYS. S. B. Simmons. Feb. 1955. 40p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: COMPOSITIONAL ANALYSIS.

Spectrophotometric procedures are presented for the analysis for Mo, Cu, P, Ni, Cr, Mn, Si, Ti, and Fe in low-alloy steels and Al alloys. (C.W.H.)

861 WADC-TR-54-101(Pt.2)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDIES OF PHASE RELATIONSHIPS AND TRANSFORMATION PROCESSES OF TITANIUM-ALLOY SYSTEMS.

[Period covered] January 11, 1954 through October 11,

1954. D. J. McPherson and W. Rostoker. Apr. 1955.

72p. Project title: METALLIC MATERIALS. Task title: TITANIUM METALS AND ALLOYS. Contract AF 33(616)-2351.

Progress is reported on the following investigations: aging characteristics and structural stability of Ti alloys; mechanism of tempering of alpha prime; phase studies of Ti-Mo alloys; and ductility and silicon solubility in Al-Ti alloys. (See also WADC-TR-54-101.) (C.W.H.)

862 WADC-TR-54-485(Pt.II)

National Bureau of Standards, Washington, D. C.

ELECTRODEPOSITION OF TITANIUM. [Period covered] July-December 1954. Walter E. Reid, Jr., C. Agnes Gaudette, and Abner Brenner. Apr. 1955. 11p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTRO-CHEMICAL TREATMENTS. Contract AF 33(616)-53-11.

The preparation of concentrated Ti-Al and Zr-Al alloy baths by other means than use of the difficultly obtainable borohydrides of Ti and Zr was investigated. This was done by reacting in an ether solution boron trichloride, lithium aluminum hydride, aluminum chloride, and titanium or zirconium tetrachloride. Under the experimental conditions used this method was not successful. An investigation was made of the possibility of using alcohols as complexing agents in solutions of titanium halides. No metallic deposits were obtained from this type of bath. The unavailability of lithium borohydride (used to prepare titanium and zirconium borohydrides) from commercial sources made necessary an examination of methods for preparing

this compound and a quantity was prepared. (For preceding period see WADC-TR-54-485(Pt.1)) (auth)

863 WADC-TR-54-492

Climax Molybdenum Co. of Michigan, Detroit.

OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM.

[Summary Report for December 1950-December 1954].

J. R. Blanchard. Dec. 1954. 64p. Project title: METALLIC MATERIALS. Task title: CORROSION AND HEAT RESISTING ALLOYS. Contract AF33(616)-2488.

Sprayed-metal coatings, applied with commercial metallizing equipment, for the protection of molybdenum against oxidation at 1700 and 1800°F were investigated. The procedures employed for applying and testing coatings are described. Tests with electroplated chromium coatings are also included. The results obtained and summarized showed that 12 of the oxidation-resistant alloys investigated had the capacity to protect molybdenum against oxidation for at least 500 hr at 1700 and 1800°F. Two aluminum-chromium-silicon alloy coatings and a Colmonoy No. 5 coating were investigated more thoroughly than other compositions. These coatings had the capacity to protect molybdenum from oxidation while sustaining elongations of 2 to 5% in 100 or 500 hr at 1800°F. They were capable of withstanding a fair amount of thermal shock and could be ground to a smooth finish. (auth)

864 WADC-TR-55-22

Handy and Harman, Bridgeport, Conn.

OXIDATION RESISTANT BRAZING ALLOYS. [Period

covered June 30, 1953 to December 31, 1954]. George H.

Sistare, Jr. and Allen S. McDonald. Apr. 1955. 44p.

Project No. 1252. Task title: BRAZING ALLOY

DEVELOPMENT. Contract AF 33(616)-2205.

Some 117 experimental brazing alloys were prepared at the Handy and Harman research laboratories, and evaluated as possible candidates for joining heat conducting metal fins to Inconel tubing for service at temperatures in the order of 1400 to 1600°F where oxidation resistance of the joint was mandatory. Alloys of Au-Ni-Cr, and Pa-Ni base alloys with Cr and Si were developed which can be used to join stainless steel to Inconel at brazing temperatures in the range of 1900 to 1950°F. The alloys can be torch brazed using flux, or used without flux in a protective atmosphere. The resulting joints resist oxidation at 1600°F service temperature. It is still possible that with further development Pa-Ni base alloys with Si-P-B additions can be produced which will braze in the temperature range from 1850 to 1900°F. A note on graphic brazing is included. (auth)

865 WADC-TR-55-96

Climax Molybdenum Co. of Michigan, Detroit.

DEVELOPMENT OF MOLYBDENUM NOZZLE BLADES.

D. V. Doane. Apr. 1955. 18p. Project title: METALLIC

MATERIALS. Task title: HIGH TEMPERATURE ALLOYS.

Contract AF33(600)-23851.

This report describes the development of methods to produce coated Mo gas turbine guide vanes (nozzle blades). Sixty vanes have been fabricated and 6 vanes have been coated, using two different coating procedures. The detailed fabrication procedures, coating experiments, and detailed coating procedures are presented. (auth)

866 WADC-TR-55-212

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECT OF ELEVATED TEMPERATURE ON THE

FATIGUE STRENGTH OF SINTERED-ALUMINUM POWDER. Period Covered January 15, 1953 to May 15, 1955. W. S. Hyler and H. R. Grover. Aug. 1955. 49p. Project Title: METALLIC MATERIALS. Task Title: DEFORMATION MECHANISMS OF METALS. Contract AF 33(616)-434.

The fatigue behavior of three sintered aluminum products was studied at elevated temperatures (800 to 1000°F) under completely reversed axial loading. Both unnotched and notched ($K_t = 3.0$) specimen behavior was investigated. Data were compared with available data on wrought aluminum alloys. Materials such as M257, M276, and SAP were shown to have equal or better unnotched fatigue strength at 800°F than do most wrought aluminum alloys at 400 to 500°F. However, notched specimen behavior suggests that these materials at 800°F and above may be notch sensitive. All three materials were observed to have metallurgical discontinuities in the form of a second phase or as inclusions. Metallographic observations showed that such discontinuities frequently were associated with the origin of the fatigue failure. (auth)

867 WAL-401/149-20

Columbia Univ., New York. School of Mines.
THE INFLUENCE OF OXYGEN ON THE TRANSFORMATION CHARACTERISTICS OF SOME TITANIUM-MOLYBDENUM ALLOYS. Final Technical Report. George L. Kehl and Alfred E. Riccardo. Oct. 31, 1955. 82p. DA Project No. 593-08-021. Contract DA-30-069-ORD-1420. (CU-2-55-ORD-1420-Met.)

The influence of dissolved O_2 in the Ti-Mo alloys investigated was to shorten the time for initiation and completion of isothermal transformation, and to raise the region of rapid transformation of the time-temperature-transformation curve to higher temperature levels. For an alloy of given Mo content, the M_s temperature level increased linearly with increase in O_2 content. It appeared that the increase in temperature level per increment increase in O_2 content was nearly independent of Mo content. For given Mo contents and like transformation temperatures, the hardnesses of the resulting structures increased with increase in O_2 content. The magnitude of the effect, however, became less pronounced at high O_2 and Mo contents, and at the higher transformation temperature levels. Highest hardnesses were obtained in structures formed at low transformation temperatures. At intermediate transformation temperature levels, hardness peaks were obtained after 40 to 60% transformation; at relatively high transformation temperatures, peak hardnesses were obtained at the onset of transformation. (auth)

868 AEC-tr-2232

ON THE ELASTIC TWINNING OF METALS. V. I. Startsev and V. M. Kosevich. Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 101, 861-4(1955). 5p.

Investigations of elastic twinning in Bi, Zn, and Sb were carried out at room temperature. Sb was found to exhibit elastic twinning under these conditions while Bi and Zn did not. A relationship between elastic twinning and melting point and elasticity is suggested. Differences in metal twinning and ionic crystal twinning are discussed. (D.E.B.)

869 AEC-tr-2260

THE DIFFUSION OF Sb AND Sn IN THE SEMICONDUCTOR SbZn. B. I. Boltaks (Boltax). Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 100, 901-3(1955). 3p.

Problems connected with studies on the processes of self-

diffusion and chemical diffusion in metals and alloys, and the physical properties of semiconductors are briefly reviewed. Results are presented from an investigation of the temperature dependence of the diffusion coefficient of Sb and Sn in the semiconductor SbZn. The measurements of the diffusion coefficients were carried out by the sectioning method and the use of Sb^{124} and Sn^{113} . (C.H.)

870 AEC-tr-2277

POISSON'S COEFFICIENT IN THE PLASTIC RANGE.

A. M. Zhukov. Translated from Izvest. Akad. Nauk S.S.S.R. Odel. Tekh. Nauk, No. 12, 86-91(1954). 11p.

The change which occurs in Poisson's coefficient (the ratio of the fractional transverse contraction to the fractional longitudinal extension of a body under tensile stress) with the increase of plastic deformation is discussed. Experimental results are reviewed and found to be very inconsistent. Using mechanical tensometers, an attempt was made to determine the change in the Poisson coefficient in relation to a longitudinal deformation directly from the experiment for a simple elongation. Tests were conducted on solid Al and steel cylindrical samples ~30 mm in diameter. Results show that the Poisson coefficient increases sharply when plastic deformations appear up to an elongation of ~1%. After this a smooth and very small increase occurs in the coefficient. (M.P.G.)

871 AEC-tr-2313

ON THE INFLUENCE OF HOLES IN THE CRYSTAL LATTICE ON THE ELECTRICAL RESISTIVITY OF METALS. B. G. Laevrev (Lazarev) and O. N. Ovcharenko. Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 100, 875-8(1955). 5p.

In order to study the influence of holes in the crystal lattice on the electric resistivity of metals, the excess resistance was obtained for Au and Pt specimens quenched rapidly from a temperature T, at which the specimen was annealed for a time sufficient to produce an equilibrium concentration of vacancies. Data are given in graphical form. (B.J.H.)

872 AEC-tr-2318

THE CHANGE OF COORDINATION NUMBER ON THE MELTING OF METALS. O. Ya. Samoilov (Samoylov). Translated by S. Rothman from Doklady Akad. Nauk S.S.S.R. 83, 447-50(1952). 5p.

The changes in coordination numbers of metals on melting have been correlated to the volume increases which are due to discrete local rarifications in the liquid. (C.W.H.)

873 NACA-TM-1384

METALLOGRAPHY OF ALUMINUM AND ITS ALLOYS. USE OF ELECTROLYTIC POLISHING. (Métallographie de l'Aluminium et de ses Alliages. Emploi du Polissage Électrolytique). P. A. Jacquet. Translated by Mary L. Mahler from O.N.E.R.A., No. 51, (1952). 80p.

Recent methods are described for electropolishing aluminum and aluminum alloys. Numerous references are included of electrolytic micrographic investigations carried out during the period 1948 to 1952. A detailed description of a commercial electrolytic polishing unit, suitable for micrographic examination of aluminum and its alloys, is included. (auth)

874 T-146-R

ON THE QUESTION OF THE ELECTRODEPOSITION OF "BLACK NICKEL." N. P. Fedot'yev, P. M. Viacheslavov, and N. P. Gnusin. Translated by E. R. Hope from Zhur.

Priklad. Khim. 25, 322-4(1952). 7p. (AD-59634).

The best conditions for the electrodeposition of "black nickel" were found to be: temperature, 45 to 55°C; current density, 0.2 to 1.3 amp/cm²; pH, 4.5 to 5.5; nickel anodes; and bath composition—Ni salts, NH₄CNS, ZnSO₄, and H₃BO₃. Several techniques are suggested for improving the quality of the Ni coating. (C.W.H.)

875 TIB/T4119

DETERMINATION OF SODIUM CONTENT IN METALLIC ALUMINIUM. (Nátrium Meghátározásá Fémalumíniumban). E. Papp, L. Zombory, and J. Hadl. Translated from *Aluminium* (Budapest) 3, 217-20(1951). 7p. (AD-40079)

876 TT-556

KINETICS OF CARBON ELIMINATION FROM A STEEL BATH. (Kinetika Vygoreniia Ugleroda Iz Stal'noi Vanny). L. A. Shvartsman, A. M. Samarin, and M. I. Temkin. Translated by G. Belkov from *Zhur. Fiz. Khim.* 21, 1027-32(1947). 16p.

The rate of carbon elimination from molten steel in the crucible of an induction furnace with contact between the surface of the metal and the air was investigated. It is shown that the rate of the process under these conditions is determined by the diffusion rate of carbon to the surface of the metal. A comparison of the observed elimination rates with the rate of the open-hearth process shows that the elimination rate is determined by physical factors. (auth)

877

ELECTRONS, ATOMS, METALS, AND ALLOYS. William Hume-Rothery. London, Iliffe and Sons, Ltd. and New York, Philosophical Library, 1955. 387p.

This book is an attempt at the presentation of recent mathematical explanations of atomic, crystalline, and nuclear phenomena in a manner that is understandable to the practicing metallurgist with little formal training in physics and chemistry. (D.E.B.)

878

DEFORMATION AND RECRYSTALLIZATION TEXTURES OF ROLLED URANIUM SHEET. Melvin H. Mueller, Harold W. Knott, and Paul A. Beck (Argonne National Lab., Lemont, Ill.). *J. Metals* 7, 1214-18(1955) Nov.

The rolling and recrystallization textures in 300°C rolled uranium sheet were investigated using a Geiger counter diffractometer with the modified Schulz reflection technique. Seven sections of sheet material were used in order to obtain sufficient data for quantitative pole figures by the reflection technique. A special integrating specimen table was used for obtaining and recording the data automatically. The rolling texture was described in terms of several "ideal orientations" in which the stronger orientations have either the (110) or (010) poles in the vicinity of the rolling direction. The recrystallization texture of the sheet uranium was also described by several "ideal orientations" which are somewhat different, except in one case, than the as-rolled "ideal orientations." (auth)

879

TRANSFORMATION KINETICS IN URANIUM-CHROMIUM ALLOYS. D. W. White, Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). *J. Metals* 7, 1221-8(1955) Nov.

The kinetics of isothermal transformation of β -to- α uranium have been studied over a broad temperature range in alloys containing from 0.3 to 4.0 atomic pct Cr. Two modes of transformation are indicated by the existence of

two C-curves in the TTT diagram. The upper temperature mode is regarded as a nucleation and growth mechanism, whose rate is controlled by diffusion of chromium in the β phase matrix. The lower temperature mode is martensitic in nature. The M. temperature increases with decreasing chromium content, suggesting that the two transformation processes become synonymous in unalloyed uranium. (auth)

880

LITHIUM ADDITIONS TO BRAZING ALLOYS. N. Bredzs and D. Canonico (Armour Research Foundation, Chicago). *Welding J.* (N. Y.) 34, 535s-43s(1955) Nov.

By comparing some chemical and physical properties of Li with the properties of some other strongly deoxidizing metals, it is shown that Li appears to be the most suitable metal for developing self-fluxing brazing alloys. The wettability tests performed with molten 1% Li-99% Ag alloy on low-carbon steel, drill rod and 303 stainless steel confirm this theoretical postulation. Small additions of Li not only reduce the oxides on the surfaces of these steels, but also considerably lower the wetting (contact) angle of molten Ag thus promoting wettability and fluidity. The Li bearing Ag alloys and the Li bearing Cu alloys should prove useful for brazing plain C steels, as well as stainless steel without flux or reducing atmospheres. The tensile strength of such joints is quite high. Preplaced Li bearing Ag alloys and Li bearing Cu alloys should torch braze stainless steel in air without fluxes. (auth)

881

CREEP OF CAST IRON CONTAINING GLOBULAR GRAPHITE. V. S. Ivanova and I. A. Oding. *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk* 7, 89-92(1955) July. (In Russian)

No change was found in measurements of cast iron samples treated in furnaces for 700 hours at 500°C. Dimensions of length were measured before and after tests with ± 0.002 mm accuracy. The limit for maximum creep (1% deformation per 100,000 hr) of iron cast with globular graphite under $T = 450^\circ\text{C}$ was 12 kg/mm² and maximum stress per 100,000 hr was 18 kg/mm². (R.V.J.)

882

ROLLING TEXTURE AND RECRYSTALLIZATION OF TITANIUM. N. V. Ageev and A. A. Babareko. *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk* No. 8, 100-6(1955) Aug. (In Russian)

Refer also to abstracts 586, 607, 613, 743, 777, 884, 996, and 1063.

TRACER APPLICATIONS

Refer also to abstract 845.

PHYSICS

883 AD-39616

Pennsylvania. Univ., Philadelphia.

SHOCK WAVE PROPAGATION IN SOLIDS: A SURVEY OF THE LITERATURE. J. R. Andersen and D. E. Nestler. [1952?]. 72p. Project Frank. Contract NOrd-12772.

884 AECD-3650

[Oak Ridge National Lab., Tenn.]

TEMPERATURE GRADIENT AND THERMAL STRESSES IN

BODIES WITH UNIFORMLY DISTRIBUTED VOLUME HEAT SOURCES. F. A. Field. [Feb. 1955]. Decl. Mar. 17, 1955. 12p. Contract [W-7405-eng-26].

Determination of the thermal stresses induced in a solid in which heat is generated may serve to indicate the behavior of a material under operating conditions. Potential application of this to reactor fuel elements is foreseen, and a series of charts has been prepared to facilitate the determination of the maximum temperature differential and maximum thermal stresses induced in flat plates and thick-walled cylinders. Methods for preparing similar charts for other materials and geometries are included. (D.E.B.)

885 AECU-3081

Utah. Univ., Salt Lake City.

THE ELECTRONIC ENERGY LEVELS AND THE MASS SPECTRUM OF METHANE. Technical Report No. 4. Morris Krauss, Austin L. Wahrhaftig, and Henry Eyring. July 15, 1954. 63p. Project No. 5. Contract AT(11-1)-82.

The energies of a number of the excited electronic states of methane were calculated in an approximate fashion and the results applied to a discussion of the behavior of the methane ion. The approximations are such that the energies for most of the overall picture are useful. (auth)

886 AECU-3082

Utah. Univ., Salt Lake City.

THE MASS SPECTRA OF LARGE MOLECULES. III. METASTABLE IONS FROM PROPANE AND THE MASS SPECTRUM OF 2,2 DI-DEUTEROPROPANE. Technical Report No. 7. Allen Kropf, Austin L. Wahrhaftig, and Henry Eyring. July 15, 1954. 30p. Project No. 5. Contract AT(11-1)-82.

An investigation was made of the possible kinetic paths which propane ions take during their decomposition, with special reference to the effect of the substitution of deuterium for H. The appearance of metastable ions in the propane mass spectrum was quantitatively explained in terms of the kinetic processes. (auth)

887 BMI-997

Battelle Memorial Inst., Columbus, Ohio.

POTENTIAL MEASUREMENTS OF ALUMINUM-CLAD URANIUM SYSTEMS. Arch B. Tripler, Jr., John G. Beach, and Charles L. Faust. May 4, 1955. Decl. Aug. 26, 1955. 14p. Contract W-7405-eng-92.

The static and dynamic potentials of selected components involved in Al-clad U composites were measured in boiling distilled H₂O. The component materials studied were Al, Al-12 w/o Si (AlSi) alloy, Cu, Ni, U-12 w/o Ni alloy, and U. The apparent difference in the ability of two cladding systems, Al-AlSi-U and Al-Ni-U, to protect U in boiling H₂O was caused by factors other than those associated with galvanic corrosion couples. The experimental data, however, support the fact that U corrodes faster when coupled to Ni and Al than when coupled to AlSi and Al. (auth)

888 KAPL-1454

Knolls Atomic Power Lab., Schenectady, N. Y.

A CIRCULAR PLATE UNDER THE ACTION OF A CENTRALLY APPLIED MOMENT. J. Zickel. Sept. 28, 1954. 17p. Contract W-31-109-Eng-52. (MEMO-JZ-4)

The analysis of the circular plate under the action of a centrally applied moment is useful in the design of pressure vessels or plates with pipe attachments where the pipes are appreciably stiffer than the plates or shell wall.

A detailed analysis is presented with graphs of the existing stress coefficients. The expressions for stresses are developed in a convenient form with coefficients which are always finite. The stresses differ somewhat from those previously published. (auth)

889 NP-5804

Horizons, Inc., Cleveland.

INVESTIGATION OF A NEW METHOD FOR THE DETERMINATION OF THE COEFFICIENTS OF SURFACE DIFFUSION OF METALS. Quarterly Progress Report No. 9. Peter F. Mataich. Nov. 1, 1955. 12p. Project No. R-355-30-2. Contract AF18(600)-644.

(For preceding period see NP-5691.)

890 NP-5806

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

RELAXATION THEORY OF LUBRICATION. Technical Report No. LIV. Taikyue Ree, Antonino Fava, Izumi Higuchi, and Henry Eyring. Oct. 20, 1955. 19p. Project No. NR-032-168. Contract N7-onr-45101.

A general reduced equation was formulated for transient and steady state behavior of the viscosity of lubricants involving a single relaxation time. The steady state equation is also generalized for systems with multiple relaxation times. (auth)

891 NRL-4546

Naval Research Lab., Washington, D. C.

THE USE OF RADIOACTIVE SELF-LUMINOUS MARKERS AS SOURCES OF ILLUMINATION. L. J. Boardman. May 6, 1955. 24p. Project NR-672-010.

The results of various studies show that radioactive self-luminous deck and personnel markers can be used as simple, inexpensive, and reliable sources of illumination to assist some military operations under dark conditions. Sn⁹⁰ is the most suitable of the present radioactive isotopes for exciting the phosphors in the markers. Experiments were made using single markers and groups of markers in a variety of colors, luminances, and distances. Green markers are the most efficient illuminators since the spectral energy distribution of the light from green markers has its maximum at about the same wavelength as the maximum of the sensitivity curve of the dark-adapted eye. The distributed luminance of a white wall, illuminated by various groups of markers, was measured to show the extent of useful illumination. (auth)

892 PRL-5.16

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report No. 3 for July, August, and September 1955. Sept. 30, 1955. 75p. Contract AF33(616) AF33(616)-2851.

(For preceding period see PRL-5.15.)

893 UCRL-4531

California. Univ., Livermore. Radiation Lab.

TABLE OF MAGNETIC FIELD COMPONENTS, H_z AND H_r, DUE TO A SINGLE CIRCULAR CURRENT LOOP. Donald F. Martin, Milton M. Hill, and Manford Ferris. June 14, 1955. 6p. Contract W-7405-eng-48.

This table is an extension of a table issued by the Naval Ordnance Laboratory in 1943, which was limited in extent to values of z and r equal to the radius of the current loop. The above data are incorporated and extended to values of z from z = a to z = 2.5a, where a is the radius of the

current loop. The values for r range from $r = 0$ to $r = a$; and for the region from $z = 0.5$ to $z = 2.0$ the values of r range from $r = 0$ to $r = 1.25a$. This allows the use of the tables for the determination of magnetic field strength in a configuration of two current loops for separations up to $2.5a$. (auth)

894 WADC-TR-54-38(Pt.2)

New York. State Univ. Coll of Ceramics, Alfred. METAL AND SELF-BONDED SILICON CARBIDE. [Summary Report for] January 11, 1954 to December 29, 1954. R. E. Wilson, L. B. Coffin, J. R. Tinkelpaugh. Jan. 1955. 46p. Project No. 7350. Contract AF33(038)-16190. (AD-63615)

A method for the formation of dense self bonded silicon carbide by hot pressing is outlined. The presence of aluminum in small quantities was found essential to the formation of uniformly dense silicon carbide specimens. Modulus of rupture values at various temperatures, hardness, thermal shock, impact strength and electrical properties were determined for self-bonded silicon carbide containing various amounts of aluminum and iron. Modulus of rupture strength was found to increase with temperature, achieving 69,000 psi at 2500°F. Laboratory evaluation of dense silicon carbide as an uncooled rocket material showed its resistance to oxygen-propane flame erosion to be superior to any material tested previously but some cracking occurred. Molybdenum and silicon carbide was hot pressed to form dense specimens having good oxidation resistance and having a modulus of rupture exceeding 70,000 psi at 1800°F. Effects of the partial replacement of titanium carbide by silicon carbide in a sintered titanium carbide-nickel cermet are described. Infiltration of nickel into silicon carbide and titanium carbide-silicon carbide skeletons was studied and found unsatisfactory because of reactions forming silicides. (See also WADC-TR-54-38.) (auth)

895 AEC-tr-2324

TRANSIENT PROCESSES IN PLASMA WITH PLANE BOUNDARIES. R. L. Stratonovich. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 24, 269-78(1953). 12p. Available from Associated Technical Services (Trans. 61G6R), East Orange, N. J.

Boundary values are found in the case of processes in semi-infinite space with a given potential applied to a plane reflecting electrode, bounding the plasma, for the deviation from the equilibrium distribution function, for the intensity of the electric field, and for the gradient of the charge density. A method is given for the determination of transient processes in a semi-infinite plasma and also in the layer between two electrodes to which a potential difference is applied for a special form of the stationary distribution function. Expressions are obtained for the reaction of the plasma to different perturbations, in particular to a unit step function [$H(t) = 1$ for $t \geq 0$, $H(t) = 0$ for $t < 0$]. (auth)

896 AEC-tr-2325

A STUDY OF THE EFFECTS PRODUCED BY THE RELATIVE MOTION OF IONS. A. P. Malinovsky. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 25, 596-604(1953). 9p. Available from Associated Technical Services (Trans. 02G7R), East Orange, N. J.

The Coriolis effect is found in electrolyte ions. It is shown theoretically and experimentally that in the rotation of a tube containing an electrolyte through which a current

flows the ions experience a Coriolis effect. As a result, a polarization emf occurs. (auth)

897 AEC-tr-2326

A SOLAR BATTERY. P. Chechik. Translated by E. E. Budzinski from *Radio*, No. 7, p[?](1955). 2p.

898

A METHOD FOR MEASURING VAPOR EXPANSION AND DIFFUSION CONSTANTS. L. I. Ivanov, I. S. Kulikov, and M. P. Matveelva. *Izvest. Akad. Nauk Otdel. Tekh. Nauk*, No. 8, 145-7(1955) Aug. (In Russian)

A new method for measuring kinetic reactions in isotopic exchange to determine the vapor expansion of components and diffusion constant in metallic alloys is offered. (R.V.J.)

899

LUMINESCENCE QUENCHING BY OXYGEN: CYCLO-HEXANE-BENZENE-*p*-TERPHENYL. P. J. Berry and Milton Burton (Univ. of Notre Dame, Ind.). *J. Chem. Phys.* 23, 1969-70(1955) Oct.

A study of gamma-induced luminescence in a solution of *p*-terphenyl in solvent of varying relative concentrations of cyclohexane and benzene indicates that a minimum luminescence of oxygenated solutions occurs in a mixture ~ 2% benzene. Oxygen quenching is due, it is believed, to the quenching of excited states of the solvent. (C.W.H.)

900

SUPERCONDUCTIVITY OF ZIRCONIUM ALLOYS. B. T. Matthias and E. Corenzwit (Bell Telephone Labs., Murray Hill, N. J.). *Phys. Rev.* 100, 626-7(1955) Oct. 15.

The superconducting transition temperatures of alloys between zirconium and VIIIth column elements are substantially higher than those of zirconium. The same is true for zirconium-gold alloys. This observation confirms a rule previously established about the height of transition temperatures. (auth)

901

ATOMS AND ENERGY. H. S. W. Massey. London, Elek Books, 1953. 174p.

The basic scientific advances leading to the release of nuclear energy are followed. Fundamental criteria for fission and fusion are discussed, and the possible applications of these processes to the production of energy are considered. The production and use of isotopes and topics on basic cosmic ray physics are included. (D.E.B.)

COSMIC RADIATION

902 AEC-tr-2316

HIGH ENERGY PHOTON SHOWERS. I. L. Rosental', M. L. Ter-Mikaelian, and E. L. Feinberg. Translated by M. Hamermesh from *Doklady Akad. Nauk S.S.S.R.* 103, 581-4 (1955). 9p.

The recent publications concerning three cases of showers consisting only of electron-positron pairs of high energy (10^8 to 10^{10} ev and higher) in nuclear emulsions located in the stratosphere are discussed. Each shower of 20,000 to 40,000 μ contained 12 to 16 pairs and no other charged particles. The authors investigated the possibility of shower cascade entrance into nuclear emulsions and the process causing such cascade multiplication. Results show that the initial number of showers are caused by a smaller number than previously claimed. The number of photons increases with development of the shower, and originally there are fewer photons than pairs. The hypothesis that

showers are the result of common cascade multiplication in emulsion (and surrounding matter) of quite a small number of initial photons is suggested. (R.V.J.)

903 TT-560

THE ENERGY SPECTRUM OF COSMIC RAY PROTONS AT SEA LEVEL. (Das Energiespektrum Der Protonen In Der Höhenstrahlung Auf Seehöhe). H. Filthuth. Translated by D. A. Sinclair from Z. Naturforsch. 10A, 219-29(1955).

26p.

The vertical proton component between 18 and 350 Mev was analysed with a proportional counter telescope 150 m above sea level. The energy of the protons was determined from their range. The differential energy spectrum obtained has a maximum between 80 and 100 Mev and decreases rapidly in the direction of higher energies. For the vertical proton flux between 18 and 350 Mev, we obtain $0.56 \times 10^{-4}/\text{sq cm sec steradian}$. (auth)

904

OBSERVATIONS ON UNSTABLE FRAGMENTS. C. Castagnoli, G. Cortini, and C. Franzinetti (Univ. of Rome). Nuovo cimento (10) 2, 550-64(1955) Sept.

Six events interpreted as disintegrations of hyperfragments are described. Five of these are associated with releases of energy which are consistent with the values measured by other authors, and all could be interpreted as system of nucleons containing a Λ^0 . One (event 6) can only be interpreted assuming that the bound hyperon is a Ξ^- or a more massive particle. This hyperfragment is emitted from a star from which a K particle is also emitted. The hypothesis of a bound Ξ^- is briefly discussed together with possible disintegration schemes and the Q values relative to them. (auth)

905

ANALYSIS OF PROPERTIES OF SECONDARY PARTICLES IN NUCLEON-NUCLEON COLLISIONS AT VERY HIGH ENERGY. M. Schein, R. G. Glasser, and D. M. Haskin (Univ. of Chicago). Nuovo cimento (10) 2, 647-57(1955) Sept.

Momentum measurements were made on the individual secondary particles emitted in the "outer" cone of the S star. A lower limit to the momentum of the particles in the "inner" cone was obtained. The transformation from the laboratory system to the center-of-mass system can be made, using suitable approximations, on the assumption that all charged secondaries are pions. This leads to a symmetrical angular and energy distribution with all particles included in a forward or backward cone of half-angle 20° . The results are compared with various multiple production theories. It is possible to infer that there is no more than one pair of particles of protonic mass among the secondaries and that even the presence of one pair would violate symmetry. The number of K mesons must also be small. The methods of analysis should be useful on other events in this energy range. (auth)

906

THE 27-DAY RECURRENCE TENDENCY OF COSMIC RAY INTENSITY. I. J. van Heerden and T. Thambyahpillai (Univ. of Manchester, England). Phil. Mag. (7) 46, 1238-51(1955) Nov.

The 27-day recurrence tendency of the cosmic ray intensity has been studied for the nucleon, meson, and electron components of the cosmic radiation, and the amplitude of the variation is found to be greater for the

nucleon component. Furthermore, the changes in cosmic ray intensity seem to precede those of magnetic activity by 4 or 5 days. The 27-day period corresponds to the times of rotation of the sun, indicating that the cosmic ray intensity changes are associated with solar disturbances which produce magnetic storms. There is some evidence to show that the recurrence tendency is due to decreases in intensity which occur at 27-day intervals. (auth)

907

PROPERTIES OF STARS FROM NUCLEAR DISINTEGRATIONS IN DILUTE EMULSIONS EXPOSED TO 1000-MEV PROTONS. Georges Philbert. Compt. rend. 241, 944-7(1955) Oct. 10. (In French)

A study has been made of the characteristics of stars produced by the interaction of 1000-Mev protons with the nuclei in $G_52 \times$ and $G_54 \times$ emulsions. Some very general results concerning the interactions with light nuclei have been deduced. (tr-auth)

908

GEOPHYSICAL AND COSMOLOGICAL ASPECTS OF COSMIC RAYS. COMMUNICATIONS TO THE MEETING OF I. U. P. A. P., AT GUANAJATO, MEXICO, SEPTEMBER 1955. Compiled by Working Association of Primary Cosmic-Ray Research, Japan.

Papers are included on the periodic and non-periodic time variations of cosmic rays and on the origin and stellar interactions of cosmic radiation. (C.W.H.)

Refer also to abstracts 985-989.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

909 AECU-3103

RAND Corp., Santa Monica, Calif.
CRYSTAL STRUCTURES AND ATOMIC VOLUMES OF THE ELEMENTS. W. G. McMillan. Aug. 12, 1955. 13p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-64. (RM-1537-AEC)

Available data on the crystal structures of the common modifications of the elements at zero pressure are tabulated. (auth)

910 UCRL-4557

California. Univ., Livermore. Radiation Lab.
THE CRYSTAL STRUCTURE OF SODIUM AMIDE. Allan Zalkin and D. H. Templeton. Sept. 26, 1955. 18p. Contract W-7405-eng-48.

Sodium amide, NaNH_2 , crystallizes in the orthorhombic system in space group $Fddd$. There are 16 molecules in the unit cell of dimensions $a = 8.964 \text{ \AA}$, $b = 10.456 \text{ \AA}$, and $c = 8.073 \text{ \AA}$. The sodium atoms are in positions 16(f) with $y = 0.146$ and the nitrogen atoms in 16(g) with $z = 0.236$. The nitrogen atoms form irregular tetrahedra about the sodium atoms. The four sodium neighbors of each nitrogen atom are concentrated toward one side. It is suggested that the hydrogen atoms are located on the opposite side. There are no hydrogen bonds in this structure. (auth)

911

CRYSTALLINE STRUCTURE OF CrBe_{12} , VBe_{12} , and NbBe_{12} . P. I. Kripyakevich and E. I. Gladyshevskii. (L'vov State Univ.). Doklady Akad. Nauk S.S.S.R. 104, 82-4(1955) Sept. 1. (In Russian)

Studies were made with binary alloys of chromium,

vanadium, and niobium with high contents of beryllium. Radiographic tables of CrBe_{12} , VBe_{12} , and NbBe_{12} powder compounds are presented. (R.V.J.)

Refer also to abstracts 641, 741, 843, 868, and 871.

ELECTRICAL DISCHARGE

912 LRL-158

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

VACUUM SPARKING: A BIBLIOGRAPHY. O. E. Meyers and W. A. Raatz. Feb. 1955. 49p. Contract AT(11-1)-74.

913 AEC-tr-2320

PHOTOELECTRIC INVESTIGATION OF THE SPECTRUM FROM THE CHANNEL OF A SPARK DISCHARGE. L. A. Vainshtein, A. M. Leontovich, L. P. Malyavkin, and S. L. Mandel'shtam. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 24, 326-38(1953). 14p. Available from Associated Technical Services (Trans. 60G6R), East Orange, N. J.

A description is given of the method and apparatus for photoelectric registration of the intensity of spectral lines in a single pulse of a spark discharge, using an oscilloscope. An investigation is made of the change taking place during the process of development of a spark discharge in air, of the intensities of the spectral lines of nitrogen of various degrees of ionization, and of the line H_α . A number of interrelations which characterize the excitation of the spectrum in the discharge channel have been established. (auth)

914 AEC-tr-2333

EXCITATION SPECTRUM OF ELECTRONIC PLASMA IN A PERIODIC FIELD OF IONS. P. S. Zyryanov. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 25, 441-7(1953). 8p. Available from Associated Technical Services (Trans. 05G7R), East Orange, N. J.

An investigation is made of the behavior of the electronic plasma in a periodic field of ions. In the approximation of weak periodicity, it is shown that the excitation spectrum, $\omega(k)$, has a zonal character. (auth)

915

PARTICLE TRANSPORT, ELECTRIC CURRENTS, AND PRESSURE BALANCE IN A MAGNETICALLY IMMOBILIZED PLASMA. P. Stehle (Univ. of Pittsburgh). *Phys. Rev.* 100, 443-6(1955) Oct. 15.

The expression for the pressure gradient in a magnetically immobilized plasma, $\nabla p = -(1/8\pi)\nabla(B^2)$ is derived without detailed study of particle orbits and still shows the various effects which appear in a detailed treatment. (auth)

ELECTRONS

916

ANNIHILATION OF POSITRONS IN CONDENSED MATERIALS. P. R. Wallace (McGill Univ., Montreal, Canada). *Phys. Rev.* 100, 738-41(1955) Oct. 15.

An analysis of the experimental results on the annihilation of positrons in condensed materials is suggested, differing from that recently published by Dixon and Trainor. Considerations are offered which make it seem unlikely that excited states of positronium play a significant role. The long lifetime in molecular materials is

explained in terms of the formation of 1s triplet positronium, while the short lifetime in these materials is interpreted as having a complex origin. The frequency of three-quantum annihilation, the temperature effect of the long lifetime, the angular correlation of the γ rays, and annihilation in superconductors are discussed. (auth)

917

PHYSICS AND APPLICATIONS OF SECONDARY ELECTRON EMISSION. H. Bruining. London, Pergamon Press Ltd. and New York, McGraw-Hill Book Co., Inc, 1954. 178p.

This book represents a survey of the physics and applications of secondary electron emission. In the first seven chapters, the physical side of secondary electron emission is discussed. The final three chapters deal with the applications of electron multiplications, the elimination of disturbing effects due to secondary electrons, and the use of secondary emission in storage devices. (D.E.B.)

918

IONIZATION AT THE ORIGIN OF ELECTRON PAIRS, AND THE LIFETIME OF THE NEUTRAL PION. D. H. Perkins (Univ. of Bristol, England). *Phil. Mag.* (7) 46, 1146-8 (1955) Oct.

Measurements of ionization along the paths of energetic pairs indicate a reduction in ionization near the origin of the pair. This reduction is attributed to the behavior of the pair as an electric dipole near the origin and as two monopoles further along the path. Determination of this effect is believed to be of value in estimating γ energies in the region 1000 Bev and above. An estimate of the lifetime of π^0 mesons yields a value of 1.2 to 5×10^{-15} sec. (D.E.B.)

Refer also to abstract 1011.

GASES

919 UCRL-3136

California. Univ., Berkeley. Radiation Lab.

PRESSURE RISE IN VACUUM CHAMBER FROM RELEASE OF LIQUID HYDROGEN. John W. Mark, Robert D. Watt, and William G. Richards. Sept. 19, 1955. 18p. Contract W-7405-eng-48.

The pressure rise in a vacuum chamber caused by the sudden release of liquid H_2 into it was studied. Ten trials were made in which different quantities of H_2 and different relief ports were used. The liquid, which was expanded from equilibrium conditions at 115 psia into a chamber 10 to 50 times the liquid volume, vaporized and caused a pressure rise of from 5 to 2 atm. absolute pressure. The exhaust from one test exploded spontaneously, and another was intentionally burned. The explosion was violent, but the intentional burn was just a big torch 40 feet long for 1.25 seconds. (auth)

920

A TABLE OF THE RADIATIVE OPACITIES OF A NUMBER OF GAS MIXTURES. Geoffrey Keller and Roland E. Meyerott (Argonne National Lab., Lemont, Ill.). *Astrophys. J.* 122, 32-42(1955).

Rosseland mean opacities have been computed for gas mixtures at temperatures ranging from 10^5 to 2×10^7 degrees and for a range of densities dependent upon the temperatures. Thirteen mixtures, most of which are rich in H and He, have been investigated. (auth)

Refer also to abstracts 631, 735, and 928.

INSTRUMENTS

921 AERE-EL/R-1676

Gt. Brit. Atomic Energy Research Establishment,
Harwell, Berks, England.

THE DESIGN OF A TRANSDUCTOR FOR A VOLTAGE
STABILISED D. C. POWER UNIT. F. H. Wells. Dec. 29,
1954.

Equations for the design of a transducer to be used as the control element in a stabilized-voltage d-c power unit are developed. The voltage reference used is a neon stabilizer valve and the application of the theory to power units giving 300 V at 300 ma load and 200 V at 200 ma load is considered in detail. (auth)

922 CERN-PS/RGb-8

[European Organization for Nuclear Research, Geneva].
APPAREILLAGE DU TYPE F. [Apparatus of the F Type].
R. Gabillard. Sept. 1955. 36p.

A description is given of an apparatus which produces a pulse when the instantaneous frequency of a variable frequency voltage, which is applied to it, goes through a determined value. The variable frequency voltage is applied to a parallel resonant LC circuit, and the resulting high frequency oscillation in the LC circuit is detected by a germanium diode and produces a voltage proportional to its amplitude. (tr-auth)

923 NP-5816

Gt. Brit. Atomic Energy Research Establishment,
Harwell, Berks, England.

LIST OF ELECTRONIC EQUIPMENT DESIGNED BY THE
ELECTRONIC DIVISION. Issue 2. Apr. 1955. 90p.

924 NYO-5079

Mallinckrodt Chemical Works, St. Louis.

THE MANOMETER SYSTEM ON THE HYDROGEN
FLUORIDE STORAGE TANKS. Earl Miller. Feb. 5,
1945. Decl. Nov. 2, 1955. 15p. Contract W-7405-eng-29.

In order to determine the approximate amount of HF in storage tanks, they were equipped with a manometer system. This system is installed so that it measures the differential pressure between the top and bottom of the liquid layers in the tanks. Since this differential pressure is proportional to the liquid level in the tanks, it is possible to derive a relationship between the differential pressure reading of the tanks and their contents. (D.E.B.)

925 NYO-7165

Franklin Inst. Labs. for Research and Development,
Philadelphia.

DILATOMETER FOR STUDYING THE DENSIFICATION OF
POWDERED COMPACTS. I. G. Greenfield, R. L. Smith,
and J. L. Rutherford. July 1955. 10p. Contract AT
(30-1)-1484.

926 TID-5215

California. Univ., Berkeley. Radiation Lab.

MAGNETS AND MAGNETIC MEASURING TECHNIQUES.
R. K. Wakerling and A. Guthrie, eds. June 1949. Decl.
Apr. 15, 1955. 220p. Contract W-7405-eng-48. (NNES-
I-2)

The theory and design of magnets are discussed with particular reference to the design of calutron magnets. The use of scale models in the design of all types of calutron magnets is described. Performance tests on specific models and on full-scale magnets are discussed. A brief description is presented of magnetic measuring instru-

ments including the ballistic galvanometer, the electronic fluxmeter, and the magnetic balance for measuring low permeabilities. Techniques used in making magnetic measurements are reviewed. (M.P.G.)

927 TID-5216

California. Univ., Berkeley. Radiation Lab.

ELECTRICAL CIRCUITS FOR CALUTRONS. R. K.
Wakerling and A. Guthrie, eds. June 1949. Decl. Apr.
15, 1955. 287p. Contract W-7405-eng-48. (NNES-I-3)

928 UCRL-4559

California. Univ., Livermore. Radiation Lab.

GLO-BALL DEVELOPMENT. James F. Steinhaus.
Sept. 4, 1955. 29p. Contract W-7405-eng-48.

The term "glo-ball" is used to designate a small, thin-walled, partially evacuated glass sphere containing He, used for investigating electric field distributions in r-f resonant cavities. Ionization, or firing, of the gas in the glo-ball indicates a given potential gradient across it; a monitoring loop is used to record the voltage required in the cavity to produce this ionization. Glo-balls were developed specifically for their application to linear accelerators. Experiments were conducted to provide a method of making glo-balls under controlled conditions with known constituents and having a stable and relatively low firing gradient. Factors associated with the making of a glo-ball were determined, and a spectroscopic analysis identified the gas components. It is now possible to make a ball which fires at a minimum voltage gradient with excellent stability. Other characteristics of the glo-ball pertinent to its use as a field measuring device were investigated. (auth)

929 WADC-TR-54-601

Wright Air Development Center. Materials Lab., Wright-
Patterson AFB, Ohio.

A MODIFIED ADIABATIC CALORIMETER. Myron W.
Belaga, David Coddington, and Hyman Marcus. Mar. 1955.
36p. Project title: MATERIALS ANALYSIS AND
EVALUATION TECHNIQUES. Task title: THERMAL
MEASUREMENTS.

A modified adiabatic type calorimeter, capable of measuring the heat capacities of organic liquids (natural and synthetic) in the temperature range of 100 to 500°F, was designed, built, and calibrated. A fixed rate of power is supplied to the sample, and a bath which surrounds the sample container is maintained at the same temperature in order to prevent heat losses from the sample. The heat capacity of an unknown material may be calculated from measurements of the time rate of temperature rise, heat input, and mass of the sample. The calorimeter has been designed for rapid, simple sample changing. Calibration with materials of known heat capacity (water, castor oil, and linseed oil), gave the following relation between the calorimeter constant and temperature: $K(t) = 0.256 - 3.706 \times 10^{-5}t + 6.839 \times 10^{-7}t^2$. (auth)

930 AEC-tr-2319

FREQUENCY STABILIZATION OF A THREE CENTIMETER
KLYSTRON BY MEANS OF A SPECTRAL LINE. N. A.
Irisova, M. E. Zhabotinski, and V. G. Veselago. Trans-
lated from *Radiotekhnika* 10, 26-35(1955). 9p.

A method for stabilizing the frequency of a klystron oscillator by means of a gas-absorption spectral line is proposed. The results of a theoretical analysis of the

circuit, the principal design equations, and the characteristics of an actual model circuit are given. (auth)

931

NUCLEAR BATTERIES: TYPES AND POSSIBLE USES. Alexander Thomas (Tracerlab, Inc., Boston). Nucleonics 13, No. 11, 129-33(1955) Nov.

Several types of nuclear batteries are reviewed, and their advantages are discussed. Power costs are also estimated. (B.J.H.)

932

METHOD FOR MAINTAINING LEVEL OF LIQUEFIED GAS REFRIGERANTS. Robert D. Goodwin (Air Reduction Co., Inc., Murray Hill, N. J.). Rev. Sci. Instr. 26, 1052-3 (1955) Nov.

Controls are described for maintaining a constant level of liquid N in a still-head can. A small electric solenoid valve is employed directly in the liquid N line, operating under the control of a sensitive level switch. The method and associated instruments are described, including a rapid means for changing supply cans. (auth)

933

A SUFFICIENTLY FAST AND ECONOMICAL SWEEP CIRCUIT. D. Brini, L. Peli, O. Rimondi, and P. Veronesi (Univ. of Bologna, Italy). Nuovo cimento (10) 2, 644-6(1955) Sept.

A sweep circuit, employing a very low number of secondary emission tubes (EFP 60) has been built. The sweep times of this circuit are within 40 and 3,000 μ sec, on 10 cm of track. The linearity curves are also reported. (auth)

Refer also to abstracts 729 and 938.

ISOTOPES

934

TWO NEW ISOTOPES OF RUTHENIUM AND RHODIUM. G. B. Baro, P. Rey, and W. Seelmann-Eggebert. Publ. com. nacl. energia atomica (Buenos Aires), Ser. quim. 1, No. 3, 19-28(1955). (In Spanish)

A new series of mass number 108 (110) was found. The half life of Ru^{106} is nearly the same as that of the Ru^{107} with a mean value of 4 minutes for both of them. The half life of Rh^{108} is 18 ± 2 seconds and its maximum β energy is about 4.5 Mev. It also emits γ rays of several energies, so that the total disintegration energy is likely to be higher than 4.5 Mev. The Ru^{107} was produced by a $\text{Pd}^{110} (n, \alpha) \text{Ru}^{107}$ reaction, which confirms the mass number of the mother substance of 23-minute rhodium as 107. The Ru^{107} emits β rays with maximum energy of about 4 Mev and γ rays as well. The Ru^{105} was also found by a (n, α) reaction. The half life of Rh^{107} was found to be 23 ± 0.5 minutes, its maximum β energy being 1.25 Mev. The Laboratories of Nuclear Spectroscopy of the Comisión Nacional de la Energía Atómica found several γ lines. One line of 315 kev coincides probably with the 1.25 Mev β particles, so that the total Q value is about 1.5 Mev. No Ru isotopes with half lives between 1.5 and 4 minutes were found among fission products. (auth)

935

ISOTOPE EFFECTS IN THE CHROMIC ACID OXIDATION OF 2-PROPANOL-2-t. Louis Kaplan (Argonne National

Lab., Lemont, Ill.). J. Am. Chem. Soc. 77, 5469-71(1955) Nov. 5.

The relative rates of oxidation of 2-propanol and 2-propanol-2-t by aqueous chromic acid have been measured by a competitive method. In the presence of manganous ion, added to isolate the rate-determining oxidation by acid chromate ion, the discrimination factor, $k_T/k_H = 0.04 \pm 0.02$, is consistent with the ratio of rate constants, $k_D/k_H = 1/7$, previously obtained. In the absence of manganous ion, the observed discrimination factor varies with perchloric acid concentration from $k_T/k_H = 0.13$ in 0.3M acid to $k_T/k_H = 0.26$ in 2M acid. It has been possible to estimate the magnitude of the isotope effects for the oxidation of 2-propanol by lower valence states of chromium. It is concluded that C-H bond rupture, which occurs in the rate-determining step of the attack by acid chromate ion, must likewise occur, at least predominantly, in the slow steps of the subsequent oxidations by the lower-valent species. Attack at the hydroxyl hydrogen may, however, occur to a significant extent at high acid concentrations. (auth)

936

STATISTICAL MECHANICS OF MIXTURES OF ISOTOPES. G. V. Chester (Yale Univ., New Haven, Conn.). Phys. Rev. 100, 446-54(1955) Oct. 15.

The excess free energy of a mixture of isotopes is expanded in a Taylor series in powers of the relative mass differences $(m_0 - m_j)/m_j$ and m_0 are the masses of the particles of the j th component and of a reference isotope, respectively. This expansion is only useful if it assumed that all the particles in the mixture obey classical or Boltzmann statistics. When this assumption is made it is found that the linear term in the expansion vanishes identically. The second-order term has the form $\sum_i \sum_j x_i x_j (\lambda_i - \lambda_j)^2 \cdot Q$, where Q is a universal function of m_0 , T , and V , λ_i equals $(m_0 - m_i)/m_i$, and x_i is the mole fraction of the i th component. This expression gives the explicit dependence of the excess free energy on the mole fractions and on the relative mass differences λ_j . From this result it can be shown, among other things, that a phase separation of the isotopes in a mixture should take place at a sufficiently low temperature. It can also be shown that there is an approximate law of corresponding states between different mixtures of isotopes. The theory is directly applicable to all solid mixtures and to fluid mixtures of the hydrogen isotopes. Unfortunately, owing to the lack of experimental data it is impossible to test the theory rigorously. Finally it is shown how the theory can be used to interpret the behavior of He^3 - He^4 solutions. When sufficient experimental data become available, the theory should throw considerable light on the influence of quantum statistics on the properties of these solutions. (auth)

937

$\text{A}^{40}/\text{K}^{40}$ RATIOS OF FELDSPARS AND MICAS FROM THE SAME ROCK. G. W. Wetherill, L. T. Aldrich, and G. L. Davis (Carnegie Institution of Washington, D. C.). Geochim. et Cosmochim. Acta 8, 171-2(1955) Sept.

$\text{A}^{40}/\text{K}^{40}$ ratios have been determined for feldspars and micas from the same rock from seven geologic settings. The $\text{A}^{40}/\text{K}^{40}$ ratio for micas is higher than that for the feldspar in every case. (auth)

Refer also to abstract 594.

ISOTOPE SEPARATION

938 TID-5218

California. Univ., Berkeley. Radiation Lab.

SOURCES AND COLLECTORS FOR USE IN CALUTRONS.

R. K. Wakerling and A. Guthrie, eds. June 1949. Decl.

Apr. 15, 1955. 280p. Contract W-7405-eng-48. (NNS-I-6)

939 AEC-tr-2315

CONCENTRATION OF ISOTOPES BY VERY RAPID

ELECTROMIGRATION ON PAPER. Andre Bonnin, Marius

Chemla, and Pierre Sue. Translated from *Compt. rend.*

241, 40-2(1955). 2p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-6393.

Refer also to abstract 927.

MASS SPECTROGRAPHY

940

STUDY OF THE ELECTRON BEAM OF MASS SPECTROMETER ION SOURCES. Rene Vauthier. *Compt. rend.*

241, 1033-6(1955) Oct. 17. (In French)

In order to study the difficulties in the operation of spectrometer ion sources, a study was made of the collector current as a function of the total electron current and the magnetic field. The data are given in graphical form. (B.J.H.)

MATHEMATICS

941 AECU-3107

Knolls Atomic Power Lab., Schenectady, N. Y.

PRECISE CLOSED-FORM SOLUTIONS OF SOME MIXED BOUNDARY VALUE PROBLEMS OF PLANE ELASTICITY.

G. Horvay and J. S. Born. [1954?]. 26p. Contract [W-31-109-Eng-52].

Precise solutions are given for the problem of the semi-infinite strip extending from $x = 0$ to $x = \infty$, stress-free along the edges $y = \pm 1$, when the edge $x = 0$ is subject (a) to a quadratic shear displacement and zero normal stress, (b) to a cubic normal displacement and zero shear stress. These are the two simplest (non-trivial) end problems of the semi-infinite strip, anti-symmetric in y , that may be formulated. The corresponding symmetric problems, (a) linear shear displacement and zero normal stress, (b) quadratic normal displacement and zero shear stress, were solved in earlier papers. (auth)

942 ORNL-1897

Oak Ridge National Lab., Tenn.

BIBLIOGRAPHY ON NUMERICAL ANALYSIS. Alston S.

Householder. July 5, 1955. 33p. Contract W-7405-eng-26.

943 UCRL-4540

California. Univ., Livermore. Radiation Lab.

ON NUMERICAL APPROXIMATION TO MULTIPLE INTEGRALS. Ramon E. Moore. July 21, 1955. 14p.

Contract W-7405-eng-48.

A technique for choosing integration formulas and mesh spacings which will provide an approximation of required

accuracy to a given definite multiple integral is presented. A scheme is included for minimizing, within the framework of the technique, the number of evaluations of the integrand required. (auth)

944

NUMERICAL METHODS. Andrew D. Booth. London, Butterworths Scientific Publications, 1955. 195p.

Included in this book are discussions of the nature and purpose of numerical analysis, the nature of tabulated functions, interpolation, numerical differentiation and integration, the summation of series, the solution of ordinary differential equations, simultaneous linear equations, partial differential equations, non-linear algebraic equations, approximating functions, Fourier synthesis and analysis, and integral equations. (B.J.H.)

945

QUANTUM FIELD THEORY WITH CAUSAL OPERATORS AND SCHWINGER'S FUNCTION. Yu. V. Novozhilov. (Lenin State Univ.) *Doklady Akad. Nauk S.S.S.R.* 104, 47-50(1955) Sept. 1. (In Russian)

Equations are developed for the vector potential and matrix elements of field operators, and the correlation of vector potential to Schwinger's vacuum function from outside sources is established. (R.V.J.)

Refer also to abstracts 1008, 1028, 1119, and 1139.

MEASURING INSTRUMENTS AND TECHNIQUES

946 AERE-EL/M-92

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY INVESTIGATIONS OF SCINTILLATION COUNTER TECHNIQUES FOR THE MEASUREMENT OF RADIO-ACTIVITY FROM THE HUMAN BODY. F. Wade. June 3, 1955. 16p.

Design considerations for a total-body γ -ray monitor are discussed. A detector was constructed which employs a 1.75×2 in. NaI crystal, a photomultiplier tube, and a rate meter. Results are reported from various experiments made with the scintillation detector mounted in a position suitable for total-body monitoring. The monitor was modified to employ two scintillation detectors. Procedures for measuring total-body activity and background measurements are discussed. (C.H.)

947 AERE-T/R-1367

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FEASIBILITY OF A PROPOSED METHOD OF MEASUREMENT OF THERMAL NEUTRON SPECTRA IN A THERMAL PILE. J. B. Sykes. Feb. 1954. 25p.

The possibility of measuring a thermal neutron spectrum by means of a time-of-flight method, using a pulsed point source of fast neutrons and a counter sensitive only during a certain period is discussed. Different configurations are considered, and it is shown that the proposed experiment is in general feasible, using the present apparatus and water as a moderator. (auth)

948 BNL-362

Brookhaven National Lab., Upton, N. Y.

A CARBON IONIZATION CHAMBER FOR GAMMA-RAY MEASUREMENTS IN THE BROOKHAVEN THERMAL

COLUMN. J. S. Handloser and F. B. Oleson. June 1955. 6p.

A graphite ionization chamber was constructed to measure the gamma-ray dose rate in the exposure cavity of the Brookhaven reactor thermal column. The chamber was 2 in. long, and was mounted on the end of a 7 ft-8 in. teflon stem, 1 in. in diameter. The associated electrometer provided sensitivities of 0.1 to 1.0 volts full scale, and was line-operated. Measurements of the gamma dose rate in the presence of the thermal neutron flux were made with and without the lucite specimen box. (auth)

949 HW-26207

Hanford Atomic Products Operation, Richland, Wash. THE STANDARDIZATION (nv/q) OF GOLD AND INDIUM FOILS AND THE ABSOLUTE NEUTRON FLUX DETERMINATION IN THE HANFORD STANDARD PILE. D. E. Davenport, G. L. Lynn, C. R. Richey. Aug. 27, 1954. 23p. Contract W-31-109-Eng-52.

The Hanford Standard Pile was calibrated for absolute neutron flux with a half-gram radium-beryllium neutron source in the center of the pile and gold and indium foils as the detectors. The values of the absolute thermal flux are presented. The ratio of the sensitivity of the detectors to thermal and resonance neutrons, $(nv/A_{th})/(q/A_{cd})$, was determined for 2.54 cm. \times 6.35 cm. indium foils exposed in cylindrical geometry and 2.54 cm. \times 6.35 cm. gold foils exposed flat. These values were found to be $K_{In} = 48.26 \pm 0.72$ and $K_{Au} = 77.14 \pm 1.15$. (auth)

950 NARF-55-45T

Consolidated Vultee Aircraft Corp., Fort Worth, Tex. INSTALLATION AND OPERATION OF THE FAST NEUTRON DOSIMETER. Preliminary Report. S. S. Strong. July 29, 1955. 17p. Contract AF(038)-21117, Task III. (MR-N-96)

A fast neutron dosimeter was assembled and put into operation in the laboratory with environmental conditions as near ideal as possible. All extraneous noise sources were isolated and eliminated, and various cable lengths for the pre-amplifier up to 300 feet in length were used satisfactorily. The equipment was operated for approximately 2,500 hours with no apparent ill effects. With the detector disconnected, with a detector high voltage of 4100 volts, with maximum mid-band gain (200,000) and with the pulse height selector dial at 20 volts, a count rate of 0.12 counts per minute over a 50-hour period was observed. With a detector high voltage of 2,500 volts, the maximum mid-band gain, no background count could be detected by using the fast neutron dosimeter. (auth)

951 NARF-55-67T

Consolidated Vultee Aircraft Corp., Fort Worth, Tex. NEUTRON SENSITIVITY OF ANTHRACENE DOSIMETERS. K. R. Spearman, Jr. Oct. 18, 1955. 22p. Contract AF33(038)-21117. (MR-N-100)

The response to fast neutrons of a γ -ray dosimeter, which has a 1-in. by $1\frac{1}{2}$ -in. anthracene crystal as the detector, was determined by bombarding the dosimeter with monoenergetic neutrons with energies in the interval of 0.5 to 3.5 Mev. A theoretical curve, derived from published values of the scintillation response of anthracene to protons, fitted the experimental data well over the range of energies used. The dosimeter shows considerable response to fast neutrons. The percentage of neutron dose which appears as γ dose increases with energy from zero

at zero neutron energy to a broad maximum of 30% at 11 Mev. When the neutron spectrum and flux are known, the pseudo- γ dose rate can be computed from the included graphs. (auth)

952 NBS-4342

National Bureau of Standards, Washington, D. C. EVALUATION TESTS OF QUARTZ-FIBER DOSIMETERS MANUFACTURED BY BENDIX AVIATION CORPORATION. Frank H. Day. Oct. 4, 1955. 24p. NBS Project. 0413-20-3172-3174.

The Bendix pocket dosimeter is an ion-chamber-type instrument with self-contained quartz-fiber, scale, and optical system for indication of accumulated radiation dose measured in r. The dosimeter can be procured in a number of full-scale ranges varying from 1 r to 2000 r depending upon the amount of associated capacitance, with the physical size of the dosimeter and its voltage sensitivity remaining identical for the different ranges. Data are presented from radiation and environmental tests on several of these dosimeters. (C.H.)

953 NP-4963(Suppl.)

Evans Signal Lab., Belmar, N. J. IONIZATION CHAMBER INSTRUMENTS AND TECHNIQUES. SUPPLEMENT TO A SUMMARY OF THE TECHNICAL MINUTES OF THE SIGNAL CORPS ENGINEERING LABORATORIES RADIAC SYMPOSIUM, SEPTEMBER 14-16, 1949. Charles K. Shultes, ed. 12p.

Preliminary design studies for a 6-stage survey meter for the range 0.5 to 5,000 mr/hr indicated two possibilities; a non-linear response chamber, combined with a linear amplifier, and a linear response chamber, combined with a logarithmic amplifier. Response curves for the two instruments are given. The second of the two appears to be the more satisfactory. (D.E.B.)

954 NP-5801

Chemical Corps School, Army Chemical Center, Md. THEORY AND OPERATION OF RADIAC INSTRUMENTS. Feb. 1951. 197p. (ST-RDS-5)

The theory and use of the various types of radiation detection instruments accepted for military use in 1951 are reviewed. (C.H.)

955 NYO-3345

Massachusetts Inst. of Tech., Cambridge. STUDIES OF GLASS DOSIMETERS. Final Report for the Period July 1, 1954 through June 30, 1955. Bernard E. Proctor, Samuel A. Goldblith, and Sol Davison. [June 30, 1955]. 71p. Contract AT(30-1)-1164.

An evaluation was made of silver-activated phosphate glass for the measurement of doses of γ radiation from about 10^4 to 10^7 r. The glasses investigated have a composition of 50% $Al(PO_3)_3$, 25% $Ba(PO_3)_2$, and 25% KPO_3 , to which about 8% $AgPO_3$ was added. Reproducible changes in absorption of light by the glass upon irradiation are produced in the visible and near ultraviolet region of the spectrum. The formation of active centers in the glass by the ionizing radiations is responsible for this induced optical activity. The increased number of active centers is attributed to the presence of silver. Experimental results are summarized. It was concluded that silver-activated phosphate glass dosimeters hold great promise of being simple, inexpensive, and versatile dosimeters for routine use. (C.H.)

956 UCLA-330

California. Univ., Los Angeles. Atomic Energy Project; California. Univ., Los Angeles. School of Medicine; and Wadsworth General Hospital, Veterans' Administration Center, Los Angeles.

FILM CALIBRATION OF A STRONTIUM 90 BETA APPLICATOR. A. B. Freitag, W. A. Gore, J. A. Hartman, and M. A. Greenfield. Apr. 5, 1955. 5p. Contract AT-04-1-GEN-12.

A simple film holder box can be used to expose light-protected film packs to a Sr^{90} beta applicator. Comparison of the optical densities produced by exposure to a known Co^{60} gamma source enables a determination to be made of the surface dose rate and of the depth dose distribution. These procedures may be utilized in any institution with dark room facilities and access to a standard gamma ray source. An optical comparator or densitometer is required. Comparison of the results obtained photographically with those of the manufacturer obtained via use of an extrapolation chamber indicates the former method is capable of achieving agreement within 5% of the latter. (auth)

957 UR-381

Rochester, N. Y. Univ. Atomic Energy Project. NEUTRON DOSIMETRY—A REVIEW. J. W. Baum. Feb. 2, 1955. 116p. Contract W-7401-eng-49.

This review summarizes information on the following subjects: physical processes of importance in neutron dosimetry; biological effects of neutrons; neutron sources; and instruments and methods used in neutron dosimetry. Also, possible improvements in dosimetry instrumentation are outlined and discussed. (auth)

958 AEC-tr-2331

REGRESSION OF CENTERS OF THE LATEST PHOTOGRAPHIC IMAGE. B. I. Kazantsev and P. V. Meiklyar. Translated from Zhur. Eksp'tl. i Teoret. Fiz. 28, 70-6 (1955). 7p. Available from Associated Technical Services (Trans. 49G7R), East Orange, N. J.

An investigation of the regression of the latent image centers and of subcenters has been carried out as a function of time. It has been shown that the process of regression proceeds according to a law similar to that of the drop (decrease) in photoconductivity and of the extinction of luminescence of crystals of a silver halide. (auth)

959

ARRANGEMENT FOR PRECISE SCATTERING MEASUREMENTS IN NUCLEAR EMULSIONS. W. Stodiek (Max-Planck-Institut für Physik, Göttingen, Germany). *Nuovo cimento* (10) 2, 466-70(1955) Sept.

An arrangement is described whereby, employing a simple microscope, the magnitude of the stage-noise is reduced, independent of the cell-length, so that it no longer influences the determination of the scattering angle. The insensitivity to shock or vibration permits the use of an ocular-eye-piece screw-micrometer. An auxiliary device for convenient alignment of the nuclear plates is also described. (auth)

960

OPERATION CONDITIONS OF A BUBBLE CHAMBER. (n-pentane, iso-pentane and diethyl ether). L. Bertanza, G. Martelli, and A. Zacutti (Univ. of Pisa, Italy). *Nuovo cimento* (10) 2, 487-94(1955) Sept.

A general criterion for calculation of the operating con-

ditions for a bubble chamber is deduced. Numerical tables are given for n-pentane, iso-pentane and diethyl ether bubble chambers. (auth)

961

ON THE PURIFICATION OF THE ELECTRON-PULSE IONIZATION CHAMBER. C. Cernigoi and G. Poiani (Univ. of Trieste, Italy). *Nuovo cimento* (10) 2, 677-8(1955) Sept.

The design of an ionization chamber gas purifier, which heats the gas by means of a high intensity alternating current, is given and discussed. Results obtained have been satisfactory. (B.J.H.)

962

TIME OF FLIGHT SPECTROMETER FOR FAST NEUTRONS. G. C. Neilson and D. B. James (Univ. of British Columbia, Vancouver). *Rev. Sci. Instr.* 26, 1018-24(1955) Nov.

A fast neutron spectrometer, using the time of flight method, which may also be used to study reactions involving the simultaneous emission of neutrons and gamma rays, is described. One stilbene scintillation counter is placed close to the source, the other a suitable distance away. The two are connected to a new type of coincidence time sorter which converts delay time between associated events into a pulse amplitude distribution which may be analyzed by a kicksorter, so enabling the whole range of delay times or energies to be displayed and recorded at one time. The delay time may result from neutron flight time following scattering in the first counter, from the time of flight of a neutron from the target associated with a gamma ray entering the first counter, or from a charged particle associated with a gamma ray. Using D(d,n)He^3 neutrons and a flight path of 50 cm, it has been possible to measure the energy with an accuracy of 10%. Angular correlations arising from $(-,n\gamma)$ reactions may be studied with energy discrimination of the neutrons; typical results are presented for the case $\text{Be}^9(\text{d},n\gamma)\text{B}^{10}$. (auth)

963

HIGH-RESOLUTION MAGNETIC SPECTROMETER. S. Rubin and D. C. Sachs (Stanford Research Inst., Menlo Park, Calif.). *Rev. Sci. Instr.* 26, 1029-34(1955) Nov.

A 180° point-focusing magnetic spectrometer was constructed for high resolution analysis of the momentum distribution of protons up to 2 Mev in energy. Mechanical adjustments of the poles enabled the field shape to be empirically adjusted for minimum radial aberration in the focal plane. The aperture is 0.0025 steradian, and the momentum resolution is better than 2000. (auth)

964

OPERATION OF PROPORTIONAL COUNTERS AT HIGH TEMPERATURES. A. Moljk, R. W. P. Drever, and S. C. Curran (Glasgow Univ., Scotland). *Rev. Sci. Instr.* 26, 1034-7(1955) Nov.

The operation of proportional counters at temperatures up to 900°C has been investigated and it is shown that the factors determining the maximum working temperature are thermal emission of electrons from the cathode, and the conductivity of heated insulating materials. Several types of proportional tubes are discussed and the advantages of counters with external cathodes are pointed out. Pulse spectra from quartz and glass counters containing K-capture A^{37} sources indicate satisfactory

operation at temperatures of 810°C in the case of quartz and 450°C in the case of glass. (auth)

965

HELIUM-3 FILLED PROPORTIONAL COUNTER FOR NEUTRON SPECTROSCOPY. R. Batchelor, R. Aves, and T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Berks, England). *Rev. Sci. Instr.* **26**, 1037-47 (1955) Nov.

The neutron transformation of He^3 has been applied to neutron spectroscopy in the medium energy range in order to overcome the disadvantages of previous methods which have usually been based on neutron scattering. By observing the pulse-height distribution when a proportional counter filled with He^3 , Kr, and CO_2 is irradiated with neutrons, the spectrum can be obtained. Details of the counter construction and vacuum equipment for filling the counter are described. In the range of energy from thermal to 1 Mev the spread (relative standard deviation of a peak) is about 3% and the wall effect agrees with theoretical predictions. The pulse height varies linearly with energy and some evidence suggesting that the mean energy required to produce an ion pair in Kr for He^3 nuclei is about 6% greater than that for protons is presented. Since the neutron reaction cross section of He^3 , as a function of energy, is required to evaluate neutron spectra from observed distributions, it has been re-measured in the range 120 kev to 1 Mev with greater accuracy than previous measurements. (auth)

966

HIGH-PRESSURE DIFFUSION CLOUD-CHAMBER SYSTEM. R. A. Schluter and S. C. Wright (Institute for Nuclear Studies, Chicago). *Rev. Sci. Instr.* **26**, 1053-7 (1955) Nov.

The high-pressure diffusion cloud-chamber system in use at the University of Chicago is described. The chamber is characterized by (1) 30 atm. of H_2 operating pressure, (2) a sensitive volume 16 in. in diameter and $2\frac{1}{2}$ to 3 in. deep, (3) a quite uniform and accurately known magnetic field of 12,600 gauss, and (4) unit assembly in which the magnet pole is an integral part of the chamber. Pictures are analyzed by a three-dimensional reprojection system designed to eliminate optical distortion. Devices for rapid and accurate measurement of several different types of events are described. (auth)

967

MEASUREMENT OF CURVATURE LENGTH, AND SPATIAL DIRECTION OF CLOUD-CHAMBER TRACKS. J. B. Dicks and J. I. Hopkins (Vanderbilt Univ., Nashville, Tenn.). *Rev. Sci. Instr.* **26**, 1061-4 (1955) Nov.

This method of obtaining information from stereoptic pictures of events in cloud chambers holds several advantages over methods currently in use. It permits the measurement of tracks which make large angles with the plane of the chamber. The equipment required is simple to construct. Errors involved in the measurements are small. About ten minutes are required to measure the energy and angular direction of a helical track. A disadvantage of this method is that the operator must have some experience in order to work effectively. (auth)

968

HIGH TRANSMISSION COINCIDENCE SPECTROMETER WITH GOOD RESOLUTION. T. R. Gerholm (Univ. of Uppsala, Sweden). *Rev. Sci. Instr.* **26**, 1069-72 (1955) Nov.

An electron-electron coincidence spectrometer is described. Magnetic lenses are used for the energy selection in each channel, and the coincidence counting efficiency is increased by using long lens spectrometers. At an effective transmission of 3%, relative half-widths of 1.3% (source diameter 0.2 cm) and 3.1% (source diameter 0.5 cm) were obtained. "Triangular field" focusing, introduced here, gives a favorable high luminosity in spite of small dimensions, distance between source and detector being only 25 cm in each half of the instrument. The focusing properties of this field form are discussed. Anthracene crystals cemented onto Lucite light guides serve as detectors, and it is shown that the light transmission efficiency of the guides can be considerably improved by machining them to a certain profile theoretically corresponding to 100% light collection. In practice efficiencies of 60 to 70% are obtained for Lucite light guides between 10 and 20 cm. The performance of the instrument is illustrated by some results obtained with coincidence measurements on the electron spectrum of Pb^{200} . (auth)

969

GAS COUNTING TECHNIQUES IN BIOCHEMISTRY. I. R. F. Glascock (Univ. of Reading, England). *Atomics* **6**, 329-34, 343 (1955) Nov.

The advantages of counting C^{14} samples in the gaseous phase include increased accuracy and sensitivity and the fact that smaller samples can be used. Gas counting is virtually the only reliable method for the determination of tritium and C^{14} in the same sample. The apparatus and techniques used in the preparation and measurement of gaseous samples are described in detail. (M.P.G.)

970

INVESTIGATION OF STORAGE AND ORIGIN OF THE LOCALIZED ELECTRON LEVELS IN ZINC SULFIDE PHOSPHORS. N. V. Zhukova (Moscow State Univ.). *Doklady Akad. Nauk S.S.S.R.* **103**, 1001-4 (1955) Aug. 21. (In Russian)

The origin of local levels and the storage of accumulated phosphorescence on levels of various depths as well as the thermal release of phosphorescence are studied using the thermal method for phosphorescence of phosphors. Samples of ZnS-Cu phosphors, prepared by the author, were calcined in a closed quartz crucible furnace for 15 min. in 1100° temp. Excitation was induced for 10 min. by a section of mercury spectrum from a wave of $\lambda 366$ to $\lambda 436 \text{ m}\mu$. (R.V.J.)

971

DETERMINATION OF THE CENTER OF AXIALLY SYMMETRIC GAMMA-RAY BEAMS BY SEGMENTED IONIZATION CHAMBERS. I. N. Usov (Lebedev Phys. Inst.). *Doklady Akad. Nauk S.S.S.R.* **104**, 391-2 (1955) Sept. 21. (In Russian)

A special installation is suggested for determination of the center of gamma-ray beams, emanating from a synchrotron. (R.V.J.)

972

MEDICAL SCINTILLATION SPECTROMETRY. J. E. Francis, P. R. Bell, and C. C. Harris (Oak Ridge National Lab., Tenn.). *Nucleonics* **13**, No. 11, 82-8 (1955) Nov.

Complete designs and circuitry are given for a single-channel scintillation spectrometer to be used for the measurement of isotope uptake. By counting only in the

photopeak, more accurate measurements can be made. Pulse-height spectra obtained are shown. The performance of the spectrometer is discussed in detail. (B.J.H.)

973

IMPROVED METHANE PROPORTIONAL COUNTING METHOD FOR TRITIUM ASSAY. Charles V. Robinson (New England Center Hospital, Boston). Nucleonics 13, No. 11, 90-1 (1955) Nov.

Designs are given of the equipment used, and the tritium assay procedure and efficiency are discussed. (B.J.H.)

974

FILM-BADGE DOSIMETRY: DEVELOPMENT OF A STANDARD CALIBRATION CURVE. D. G. Boyer (Idaho Operations Office, AEC, Idaho Falls). Nucleonics 13, No. 11, 106-9 (1955) Nov.

975

A FISSION COUNTER WITH HIGH FISSILE MATERIAL DENSITY FOR FAST NEUTRON FISSION COUNTING. W. D. Allen and A. T. G. Ferguson (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 38-40 (1955) Aug.

A multplate counter is described which contains up to 100 mg of fissile material within one cubic inch with a plate capacity of about 100 μf . It is reasonably robust, and has a transmission coefficient for fast neutrons of 93%. The quantity of fissile material can be easily varied. (auth)

976

SCINTILLATION RESPONSE OF ANTHRACENE CRYSTALS TO SHORT RANGE ELECTRONS. G. T. Wright (Rhodes Univ., Grahamstown, South Africa). Phys. Rev. 100, 588-90 (1955) Oct. 15.

The scintillation response of anthracene crystals to short range electrons is discussed. There is a significant difference between the response to electrons incident on the crystal surface and to electrons liberated inside the crystal. Possible explanations for this difference are discussed. The "primary" photon cascade theory proposed by Birks is considered unacceptable, particularly in view of recent measurements of the shapes of scintillation pulses. Surface escape of fluorescence, proposed previously by the author, is discussed quantitatively using the fluorescence excitation spectrum of anthracene and is considered adequate to explain the observed difference in the scintillation response curves. (auth)

977

DISINTEGRATION RATE DETERMINATION BY 4 π -COUNTING. PART III. ABSORPTION AND SCATTERING OF β RADIATION. B. D. Pate and L. Yaffe (McGill Univ. Montreal, Quebec, Canada). Can. J. Chem. 33, 1656-68 (1955) Nov.

The "coincident discharges" in a 4 π counter have been examined and found to be due in the main to gas and wall backscattering. This can be resolved into two components, scattering near to and far from the source. Curves have been obtained for the backscattering of β radiation by the source-mounting film and for the absorption of the incident and backscattered radiation. Backscattering by the film is shown to be great enough to introduce a large error into the "sandwich" method which is currently in use for correcting for source-mount absorption. (auth)

978

MEASUREMENT OF CONTINUOUS X-RAY SPECTRA WITH A SCINTILLATION SPECTROMETER. D. V.

Cormack, J. E. Till, G. F. Whitmore, and H. E. Johns (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Canada). Brit. J. Radiol. 28, 605-9 (1955) Nov.

Measurements have been made with a scintillation spectrometer of the spectral distribution of primary radiation from a 280-kv x-ray machine for hvl's of 1.7, 2.5, and 3.1 mm of copper. The measured distributions have been corrected for crystal and photomultiplier effects using measured spectra for monochromatic radiation. The corrected distributions have been compared with those obtained by analysis of absorption data. (auth)

Refer also to abstracts 544, 919, and 1017.

MESONS

979 UCRL-3156

California. Univ., Berkeley. Radiation Lab. THE MASSES OF POSITIVE K PARTICLES. Harry H. Heckman, Frances M. Smith, and Walter H. Barkas. Oct. 14, 1955. 16p. Contract W-7405-eng-48.

The program of measuring meson masses has been extended to the positive τ , $K_{\mu 2}$, $K_{\pi 2}$, $K_{\mu 3}$, and τ' particles. With the Bevatron as a source, and employing a modification of the Kerth-Stork quadrupole lens and analyzing-magnet arrangement, a mass resolution of 1.6% for an individual particle was obtained. Using the stopping behavior or the grain density of the secondary for K-particle classification, and multiple scattering as a check, practically pure samples of the above types of K mesons were obtained for analysis. The particles were compared directly with protons of the same momentum, and also with the τ meson, the mass of which is known accurately. Relative to the mean τ mass of 966 the following in electron mass units resulted: τ (966 ± 3.1), $K_{\mu 2}$ (962.5 ± 3.2), $K_{\pi 2}$ (972.2 ± 4.7), $K_{\mu 3}$ (951.2 ± 10.6), τ' (951.5 ± 10.9). These are all consistent with a single K mass of 966. The results are independent of the range-momentum relation; however, the intercomparison of the masses measured relative to the τ meson and relative to the proton check closely, indicating that there are no large systematic errors and that the shape of the range-momentum relation must be nearly correct. (auth)

980 AEC-tr-2266

THE POSSIBILITY OF OCCURRENCE OF μ^0 -MESON PENETRATING RADIATION DURING COLLISIONS BETWEEN HIGH ENERGY PROTONS AND NUCLEI. A. N. Novikov, B. M. Pontecorvo (Pontekorov), and G. I. Selivanov (Selinvanov). Translation of a pre-print from I. N. P., Ac. of Sci., U.S.S.R. by M. B. Karelitz. 7p.

"The abnormal scattering" of μ mesons cannot be explained by interaction between the nucleon field and the field of (μ, μ^0) pair. It is also concluded that the "structural" theory π mesons as proposed by Wentzel is not correct and that the contribution of (μ, μ^0) pair interaction to the nuclear forces is insignificant. (auth)

981

ANALYTICAL METHOD FOR OBTAINING PHASE SHIFTS FROM EXPERIMENTAL DATA ON PION-PROTON SCATTERING. E. Clementel, G. Poiani, and C. Villi (Univ. of Padova and Trieste, Italy). Nuovo cimento (10) 2, 389-96 (1955) Sept.

An analytical method is outlined for obtaining phase

shifts from experimental data on pion-proton scattering. As an example, phase shifts for $\pi^+ \rightarrow \pi^+$ scattering at 120, 135 and 300 Mev are calculated. The graphical translation of this method reveals the working principle of a mechanical phase shift analyzer. (auth)

982

OBSERVATIONS ON COULOMB INTERFERENCE IN $\pi^+ + p$ SCATTERING. E. Pedretti and A. Stanghellini (Univ. of Bologna, Italy) and G. Quarenzi (Univ. of Padova, Italy). Nuovo cimento (10) 2, 450-5(1955) Sept. (In Italian)

Referring to the experimental data available so far, the behaviour is traced up to 150 Mev of the phase shifts α_3 and α_{33} which concern the scattering α_{31} is considered negligible in this energy interval. From these phase shifts, the most favorable energy for an experiment which could reveal the Coulomb interference, and therefore the signs of the phase shift, has been determined. The optimum value of the energy is around 120 Mev. Until now, two experimental determinations at 113 and 120 Mev have been obtained with photographic plates. The results of the two experiments were added. The differential cross-section obtained, based on a total of 782 events, corresponds to an average energy of 117 Mev. It clearly shows that the Coulomb interference must be destructive. The phase shifts found, according to Fermi's solution, are: $\alpha_3 = -(11.1 \pm 1.0)^\circ$, $\alpha_{33} = (31.5 \pm 2.1)^\circ$, $\alpha_{31} = -(0.6 \pm 1.8)^\circ$. This solution, in comparison to the one obtained by changing all the signs of the phase shifts, is statistically preferable by a factor of 1,360. (auth)

983

ON THE $K_{\mu 3}$ -AND $K_{\beta 3}$ -DECAY SCHEMES. G. Costa and N. Dallaporta (Univ. of Padova, Italy). Nuovo cimento (10) 2, 519-25(1955) Sept.

In order to explain the three-body decays of K particles according to the reactions: $K_{\mu 3} \rightarrow \mu = \nu + \pi^0$, $K_{\beta 3} \rightarrow \beta + \nu + \pi^0$, a detailed decay scheme is proposed which seems to be the simplest possibility for obtaining for both these decays, a lifetime of the same order of magnitude as the χ -decay lifetime. This scheme is based on the assumption of both the strong Gell-Mann-Pais interaction between K particles and hyperons, and the possibility for hyperons to suffer μ and β decays regulated by the weak universal Fermi interaction constant. (auth)

984

AN UNSTABLE FRAGMENT PRODUCED ON THE NUCLEAR CAPTURE OF A HYPERON. M. Ceccarelli, N. Dallaporta, M. Grilli, M. Merlin, G. Salandini, B. Sechi (Univ. of Padova, Italy) and M. Ladu (Univ. of Milan, Italy). Nuovo cimento (10) 2, 542-9(1955) Sept.

An event is described which consists in a slow singly charged particle of superprotonic mass coming to rest in the emulsion and giving rise to an excited fragment and no other visible secondary. After a range of 46 μ m, the fragment disintegrates into a proton of 110 Mev and a singly charged particle with a range of 300 μ m, which may be either a proton or a deuteron. The event is consistent with the assumption that a negative hyperon captured by a nucleus interacts according to the reaction: $\Sigma^- + P \rightarrow \Lambda^0 + N$, the Λ^0 remaining bound into an unstable nuclear fragment. All other hyperon capture events known up to now are discussed in order to see if they could be interpreted as being due to the same reaction. (auth)

985

K-MESON AND HYPERON EVENTS. C. Castagnoli, G.

Cortini, and A. Manfredini (Univ. of Rome). Nuovo cimento (10) 2, 565-73(1955) Sept.

21 K meson and 5 hyperon events observed in the Rome laboratory after the Padua Congress are described. Detailed discussion is given of the probable interaction of a negative hyperon at rest and of the decay in flight of a hyperon ($Y \rightarrow \pi^0$) which shows a Q value of 71 ± 5 Mev and is interpreted as due to a Ξ^- -particle. (auth)

986

MESONIC DECAY OF A SINGLY CHARGED FRAGMENT. F. Anderson, G. Lawlor, and T. E. Nevin (Univ. Coll., Dublin, Ireland). Nuovo cimento (10) 2, 605-7(1955) Sept.

The results of measurements on a meson-active fragment event found in photographic emulsions are given. The event can be interpreted as the mesonic decay of either a $^2\text{H}_1$ or $^4\text{H}_1$ nucleus, containing a bound Λ^0 -particle in place of a neutron. In either case, the binding energy of the Λ^0 -particle is found to be -0.7 ± 0.8 Mev. (auth)

987

UNUSUAL DECAY OF A χ -MESON. F. Anderson, G. Lawlor, and T. E. Nevin (Univ. Coll., Dublin, Ireland). Nuovo cimento (10) 2, 608-12(1955) Sept.

An event is described in which a χ meson at rest decays to three charged particles, two of which are electrons. Details of the measurements are given and are consistent with the interpretation of a χ meson decay involving a π^0 meson which undergoes anomalous decay to two electrons and a photon. (auth)

988

ABSOLUTE LOW-ENERGY DIFFERENTIAL RANGE SPECTRUM OF COSMIC RAY μ -MESONS AT SEA-LEVEL. D. Brini, L. Peli, O. Rimondi, and P. Veronesi (Univ. of Bologna, Italy). Nuovo cimento (10) 2, 613-38(1955) Sept.

The results are given of a measurement of the differential range spectrum of μ mesons between 0 and ~ 1.5 m.w.e. at sea level. The experimental apparatus used consists of two liquid scintillation counters, placed in coincidence with each other. Between them there is the lead absorber. The lower counter, of 5.64 g/cm² thickness, works as a death thickness. The event $\mu \rightarrow e$ is detected by photographing the two successive pulses, due to the meson and electron, on a sincroscope screen. The experimental results have been corrected for any possible cause of errors. The scattering correction has been evaluated by the Monte Carlo method and experimentally verified. The results correspondent to the scattering correction show how great this influence may be. The absolute intensity at range of ~ 150 g/cm² of a.e. has resulted of $7 \cdot 10^{-6}$ (sterad.g.s)⁻¹. The spectrum between 0 and 180 g/cm² of a.e. has a slope of 0.091 ± 0.006 . (auth)

989

THE POSITIVE-NEGATIVE DIFFERENCE OF COSMIC RAY MUONS. Y. Yeivin (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) 2, 658-60(1955) Sept.

It is suggested that the positive-negative cosmic muon difference is a quantity which is directly related to collisions of the primary particles with air nuclei. Preliminary results concerning the derivation of the difference from a simple and general collision model are reported, as is the comparison of the theoretical expression with the experimental data. (B.J.H.)

990

ON THE ASSOCIATED PRODUCTION OF A MESON-ACTIVE ${}^4\text{H}_1$ FRAGMENT AND A K-MESON IN A NUCLEAR DISINTEGRATION. M. W. Friedlander, D. Keefe, and M. G. K. Menon (Univ. of Bristol, England). *Nuovo cimento* (10) 2, 663-5(1955) Sept.

A report is given of an event which was interpreted as the ejection of an unstable H^4 nucleus from a nuclear disintegration. The H^4 nucleus then decayed probably according to the disintegration $\text{H}^4 \times \rightarrow \text{He}^4 + \pi^- + \text{Q}$ with $\text{Q} \sim 55$ Mev. In the H^4 parent tracks, a K meson of mass $960 \pm 90 m_e$ was found. (B.J.H.)

991

THE PRODUCTION OF A PAIR OF HEAVY MESONS IN A HIGH-ENERGY NUCLEAR INTERACTION. M. W. Friedlander, D. Keefe, and M. G. K. Menon (Univ. of Bristol, England). *Nuovo cimento* (10) 2, 666-8(1955) Sept.

A description is given of an event in which a negative K meson is produced in association with another heavy meson. The mass of the other K particle is given as $875 \pm 65 m_e$. (B.J.H.)

Refer also to abstracts 904, 907, 918, and 1140.

METEOROLOGY

992

URANIUM CONTENT OF TWO IRON METEORITES. George W. Reed and Anthony Turkevich (Argonne National Lab., Lemont, Ill. and Institute for Nuclear Studies, Chicago). *Nature* 176, 794-5(1955) Oct. 22.

Uranium contents from 20 to 100×10^{-10} gms/gm have been reported for some Fe meteorites. A check of U content on reported samples was made by neutron activation analysis. Results of the analysis indicate no U content. (D.E.B.)

MOLECULAR PROPERTIES

993 AECU-3086

Los Alamos Scientific Lab., N. Mex.
EQUATION OF STATE OF SOLIDS. J. M. Walsh and F. L. Yarger. [nd] Decl. Dec. 13, 1954. 9p. Contract [W-7405-eng-36].

994 AECU-3088

Los Alamos Scientific Lab., N. Mex.
INFRARED SPECTRA AND STRUCTURE OF THE CRYSTALLINE SODIUM ACETATE COMPLEXES OF U(VI), Np(VI), Pu(VI), AND Am(VI). A COMPARISON OF METAL-OXYGEN BOND DISTANCE AND BOND FORCE CONSTANT IN THIS SERIES. Llewellyn H. Jones. [1954]. Decl. Jan. 31, 1955. 10p. Contract [W-7405-eng-36].

Infrared spectra of solid $\text{NaXO}_2(\text{Ac})_3$, with $\text{X} = \text{U}, \text{Np}, \text{Pu}$, and Am , have been observed. From the symmetric and asymmetric stretching frequencies of the $\text{O}-\text{X}-\text{O}$ groups, $\text{X}-\text{O}$ force constants have been calculated and were found to decrease in the order $k_{\text{U}-\text{O}} > k_{\text{Np}-\text{O}} > k_{\text{Pu}-\text{O}} > k_{\text{Am}-\text{O}}$, the respective values being 0.705, 0.698, 0.675, and 0.612 megadynes/cm. From the cell constants for $\text{NaXO}_2(\text{Ac})_3$, it is apparent that the $\text{X}-\text{O}$ bond distance decreases in the same order— $R_{\text{U}-\text{O}} > R_{\text{Np}-\text{O}} > R_{\text{Pu}-\text{O}} > R_{\text{Am}-\text{O}}$. Thus, a decrease in bond distance is accompanied by a decrease in

force constant, apparently because the bond, though shortened by contraction of the electron shells of the metal, is weakened by interaction of the extra valence shell electrons. (auth)

995 AECU-3106

Utah. Univ., Salt Lake City.
THE MASS SPECTRUM OF METHANE AND THE ENERGY LEVELS OF THE FRAGMENT IONS AND RADICALS. Morris Krauss, Austin L. Wahrhaftig, and Henry Eyring. July 30, 1955. 93p. Project No. 5. Contract AT(11-1)-82.

A molecular orbital calculation of the electronic states of CH_4 , CH_3 , CH_2 , CH , and their respective ions provided the basis for the application of correlation rules to an analysis of the existing appearance potential data for methane mass spectrum has been proposed which is based on the high value of the heat of sublimation of carbon. It is shown that the excited electronic states of the molecule- and radical-ions are prominent in the decomposition reactions. (auth)

996 SO-2043

General Electric Co. Research Lab., Schenectady, N. Y.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY. Twenty-Seventh Quarterly Report. (Progress Report No. 44). W. DeSorbo, R. E. Hoffman, and D. Turnbull. Oct. 5, 1955. 6p. Contract W-31-109-Eng-52. (55-RL-1438)

The coefficient of self-diffusion of Ge in pure Ag has been measured in the temperature range 675 to 850°C and found to be 7 to 12 times larger than the self-diffusion coefficient of Ag. The specific heat of three graphite samples is found to be significantly different in the temperature region 1.5 to 4.2°K. The evidence indicates that increased faulting, decreased particle size, or both, increases the heat capacity of graphite. (auth)

997 AEC-tr-2310

"FRACTIONAL" PEAKS IN THE MASS-SPECTRUM OF HYDROGEN. N. N. Tunitskii (Tunitskij), R. M. Smirnova, and M. B. Tikhomirov. Translated from *Doklady Akad. Nauk S.S.S.R.* 101, 1083-4(1955). 4p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-5417.

998

PHOTOIONIZATION EFFICIENCIES AND CROSS SECTIONS IN N_2O AND NO. W. C. Walker and G. L. Weissler (Univ. of Southern California, Los Angeles). *J. Chem. Phys.* 23, 1962-3(1955) Oct.

Total absorption cross sections, photoionization efficiencies, and ionization cross sections of N_2O and NO have been measured for radiation in the region between the ionization onset and 687 Å. Values obtained for the ionization potentials of N_2O and NO were 12.83 ± 0.07 and 9.20 ± 0.03 ev, respectively. (C.W.H.)

999

STUDIES OF THE IONIZATION OF MOLECULES BY ELECTRON IMPACT. I. EXCITED STATES OF THE NITROGEN MOLECULAR ION. D. C. Frost and C. A. McDowell (Univ. of Liverpool, England). *Proc. Roy. Soc. (London)* A232, 227-35(1955) Oct. 25.

A recently developed pulse technique which produces a beam of electrons with an energy spread of only 0.1 ev has been used to determine the ionization efficiency curve for

molecular N_2 in a mass spectrometer. Ionization to all four known excited states of the N_2^+ ion, including the recently identified $^2\Pi_u$ state, are clearly recognizable on the ionization efficiency curve. The several ionization potentials of the N_2 molecule, as given by this new electron impact method, are in good agreement with the values deduced from spectroscopic data. The results are also shown to be in agreement with the expectations of the molecular orbital formula for N_2 given some years ago by Mulliken (1932). (auth)

NEUTRONS

1000 BNL-354

Brookhaven National Lab., Upton, N. Y.
NEUTRON LEAKAGE FROM HYDROGEN-MODERATED SYSTEMS. T. Auerbach. June 1955. 16p.

The neutron flux in an infinite hydrogen moderator is calculated by the method of successive generations and by transport theory. It is assumed that the space variation of the fission source has the form $e^{i\alpha x}$ and that all mean free paths are constant. Solutions from transport theory are obtained to order $(\alpha\lambda)^3$ in the P_2 approximation. The flux in the infinite medium is shown to be closely related to that in a slab of finite thickness if α is identified with the geometrical buckling of the latter. The leakage is obtained by integrating the flux over the slab surfaces. It is shown to be in good agreement with results obtained from second moment theory. (auth)

1001 KAPL-42

[Knolls Atomic Power Lab., Schenectady, N. Y.]
NUCLEAR ENGINEERING COURSE, 1947-1948. PILE NEUTRON PHYSICS VII. L. Tonks. Feb. 26, 1948. Decl. Oct. 6, 1955. 13p. (Lecture Notes by L. M. Hartman).

The problem of the slowing down of neutrons is discussed, and equations for neutron distributions are given. (B.J.H.)

1002 KAPL-1318

Knolls Atomic Power Lab., Schenectady, N. Y.
ON THE TREATMENT OF GEOMETRICALLY THIN REGIONS WITHIN THE TWO-SPACE DIMENSION MULTI-GROUP DIFFERENCE EQUATION FRAMEWORK. E. L. Wachspress. Mar. 30, 1955. Decl. Sept. 19, 1955. 26p. Contract W-31-109-Eng-52.

A "geometrically thin" region required to represent a control rod is defined as a material region with a dimension in at least one direction small compared to a mean free path of neutrons within either the "thin" region or its immediate surroundings. Self-shielding factors combined with the usual diffusion theory are used to obtain five-point difference equations to be applied along the surfaces of thin regions. (auth)

1003 NYO-7455

Basel. Universität.
A RECOIL-COINCIDENCE METHOD FOR PRODUCING MONO-ENERGETIC d-d NEUTRONS. W. Franzen, P. Huber, and L. Schellenberg. Sept. 23, 1955. 20p. For Univ. of Rochester. Contract AT(30-1)-875.

A method is described for eliminating background neutrons from a d-d neutron source by recording neutrons and He^3 recoils in coincidence. The target consists of D_2 and the recoils are observed at 90° to the direction of incidence. Factors which determine the energy resolution

attainable with such a device are analyzed. Tests on an actual source of this type capable of an energy resolution of 10 kev are presented. (auth)

1004

THE ANGULAR CORRELATION OF THE PROMPT FISSION NEUTRONS. J. S. Fraser (Atomic Energy of Canada Ltd., Chalk River, Ont.). *Atomics* 6, 350-4, 358(1955) Nov.

Measurements are described which demonstrate that neutrons are emitted by rapidly moving fission fragments in a time shorter than 4×10^{-14} sec after fission. On the average, 30% more neutrons are emitted by the light fragment than by the heavy one. The apparatus used for measuring the prompt neutron angular distribution is described. Experimental results are presented for fissile sources of Pu^{239} , U^{233} , and natural U enriched to 14% in U^{235} . (M.P.G.)

1005

MODERATION AND DIFFUSION OF NEUTRONS FROM A LOCALIZED PULSED SOURCE. J. B. Sykes (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 2, 31-7(1955) Aug.

Using a polynomial expansion method, the mean time of arrival, and the variance about that mean, are found for various energies and various distances from a pulsed plane source of fast neutrons. The results are evaluated for two media. The corresponding quantities are also derived, using diffusion theory, for thermal neutrons from a pulsed point source of fast neutrons. (auth)

1006

SCATTERING OF NEUTRONS BY PHONONS IN AN ALUMINUM SINGLE CRYSTAL. B. N. Brockhouse and A. T. Stewart (Atomic Energy of Canada, Ltd., Chalk River, Ont.). *Phys. Rev.* 100, 756-7(1955) Oct. 15.

A discussion is given of the theory and experiments on the scattering of neutrons by phonons in an Al single crystal. Typical energy distributions of scattered neutrons and reciprocal lattice diagrams of the Al are shown. (B.J.H.)

1007

FISSION-NEUTRON REACTION CROSS SECTIONS. W. Inthoff (Chalmers Univ. of Tech., Göteborg, Sweden). *Nucleonics* 13, No. 11, 67(1955) Nov.

A nomogram is given for the rapid calculation of fission-neutron reaction cross sections. (B.J.H.)

Refer also to abstracts 947, 950, 1065, and 1086.

NUCLEAR PHYSICS

1008 ANL-5324

Argonne National Lab., Lemont, Ill.
TABLE OF F COEFFICIENTS. M. Ferentz and N. Rosenzweig. [1955]. 133p. Contract W-31-109-eng-38.

F coefficients, which occur in the equations describing angular correlations between successive nuclear radiations, are tabulated. The F coefficient is defined in terms of the Clebsch-Gordan and Racah coefficients. (D.E.B.)

1009 UCRL-3115

California. Univ., Berkeley. Radiation Lab.
PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, JULY 1955. Aug. 24, 1955. 48p. Contract W-7405-eng-48.

Progress is reported in the study of the $C^{12} + p \rightarrow B^9 + \alpha$ reaction at 32 Mev, elastic scattering of 30-Mev protons by Al, Cu, Ag, Au; K^+ meson lifetime, "delayed figment" occurrence at 4.8-Bev proton energies, polarization of deuterons in the reaction $p + p \rightarrow \pi + d$, and the polarization direction of the 184-inch cyclotron beam. Developmental work on the H_2 bubble chambers was continued. The status of the 4-, 10-, and 72-inch chambers is given. Emulsion track analysis was made for K-meson mass differences. Experiments and theoretical studies of a number of particle phenomena are reported. The measurement of p-p scattering cross sections are in progress. A counter telescope for detecting antiprotons is described. K^- -particle interactions at rest and K-particle production are reported. Results of studies on p-p production of π^0 mesons, β -ray spectroscopy, π -p cross sections, and Compton scattering of photons with protons are given. Research with the spiral-orbit spectrometer is summarized. Modifications of the 184 and 60 inch cyclotrons are described, and synchrotron operations are outlined. (For preceding report in series see UCRL-3014.) (D.E.B.)

1010

PRESENT STATE OF NUCLEAR MODELS OF THE INDIVIDUAL TYPE. Claude Marty (College de France, Paris). *Cahiers phys.*, No. 53, 27-37(1955) Jan. (In French)

The present state of nuclear models, in which the electrons can be regarded as being independent of each other, is reviewed. Included are analogies between certain atomic and nuclear properties, the characteristics of the nuclear models, and the applications of the model to light and heavy nuclei. (B.J.H.)

1011

β DECAY AND NUCLEAR STRUCTURE. NUCLEON-LEPTON INTERACTION, SELECTION RULES AND SHELL MODEL. Roger Nataf (College de France, Paris). *Cahiers phys.*, No. 56, 7-28(1955) Apr. (In French)

A discussion is given of the information contributed to the theory of β decay by the knowledge of nuclear structure, especially the shell model. Inversely, this theory, in spite of the ambiguities which it still shows, has been very useful for establishing the values of angular moments and parities of the nuclear levels and, consequently, the empirical rules of the shell model. Discussions are also given of the information contributed by experiment (forms of β spectra, electron-neutrino angular correlation etc.) which have permitted definition of the nucleon-lepton interaction, also determining the exact theory. (tr-auth)

1012

NUCLEAR QUADRUPOLE RESONANCE OF γ -IRRADIATED PARA-DICHLOROBENZENE. Jules Duchesne, Andre Monfils, and Julien Garsou (Univ. of Liege, Belgium). *J. Chem. Phys.* 23, 1969(1955) Oct.

The intensity of the nuclear quadrupole resonance line in p-dichlorobenzene was decreased slightly by gamma irradiation. This effect is due to the creation of imperfections in the crystal lattices and is similar to that due to impurities in the crystals. (C.W.H.)

Refer also to abstracts 1125, 1126, and 1127.

NUCLEAR PROPERTIES

1013 AECD-3655

Oak Ridge National Lab., Tenn.

THE CROSS SECTION OF Xe^{135} AS A FUNCTION OF ENERGY. S. Bernstein, C. P. Stanford, M. M. Shapiro, J. B. Dial, and T. E. Stephenson. p.6-71 of PHYSICS DIVISION PROGRESS REPORT FOR THE QUARTER DECEMBER, JANUARY, FEBRUARY 1948-1949. Decl. Apr. 20, 1955. 66p. Contract W-7405-eng-26.

The method, apparatus, and results for a series of Xe^{135} cross section measurements made at ORNL are given. This is an extract from the Physics Division Progress Report for Dec., Jan., Feb., 1948-49. (D.E.B.)

1014 AECU-3104

Stanford Univ., Calif., W. W. Hansen Labs. of Physics.

HIGH ENERGY ELECTRON SCATTERING AND THE CHARGE DISTRIBUTIONS OF SELECTED NUCLEI. Beat Hahn, D. G. Ravenhall, and Robert Hofstadter. Oct. 1955. 38p. Project R-537-20-9. Sponsored jointly by ONR; AEC; and USAF under Contract AF-18(600)-646. (HEPL-68; OSR-TN-55-320).

Experimental results are presented of electron scattering by Ca, V, Co, In, Sb, Hf, Ta, W, Au, Bi, Th, and U, at 183 Mev and (for some of the elements) at 153 Mev. For those nuclei for which asphericity and inelastic scattering are absent or unimportant, i.e., Ca, V, Co, In, Sb, Au, and Bi, a partial wave analysis of the Dirac equation has been performed in which the nuclei are represented by static, spherically symmetric charge distributions. Smoothed uniform charge distributions have been assumed. These are characterized by a constant charge density in the central region of the nucleus, with a smoothed-out surface. Essentially two parameters can be determined, related to the radius and to the surface thickness. An examination of the Au experiments shows that the functional forms of the surface are not important, and that the charge density in the central regions is probably fairly flat, although it cannot be determined very accurately. An analysis of the experiments on the nuclei Ca, V, Co, In, Sb, Au, and Bi, assuming for convenience the Fermi smoothed uniform shape, then leads to the following results: the radial parameter c (the distance to the mid-point of the surface) scales as $A^{1/3}$ for the nuclei we have examined and is $(1.07 \pm 0.02) A^{1/3} \times 10^{-13}$ cm; the surface thickness t (the $0.9 \rho_0$ to $0.1 \rho_0$ distance) is constant for all of these nuclei, to within the estimated error, and is $(2.4 \pm 0.3) \times 10^{-13}$ cm. (auth)

1015 NYO-7135

Rochester, N. Y. Univ.

SPIN-ORBIT MATRICES FOR THE NUCLEAR p-SHELL. M. E. Mandl. Oct. 17, 1955. 25p. Contract AT(30-1)-875.

A number of matrices of the one particle spin-orbit interaction operator $1/a H_{s.o.} = \Sigma \vec{1}s \cdot \vec{l}$ in the LS representation were calculated in connection with a study of the properties of p-shell nuclei. A collection of these matrices are given. (D.E.B.)

1016 ORNL-1469(Suppl.2)

Oak Ridge National Lab., Tenn.

A TABLE OF NUCLEAR MOMENT DATA. Harold E. Walchli, ed. Feb. 1, 1955. 43p. Contract W-7405-eng-26.

1017 AEC-tr-2289

DETERMINATION OF THE EXCITATION ENERGY OF NUCLEI BY TRACKS OF RECOIL NUCLEI OF STARS IN A PHOTOGRAPHIC EMULSION. V. I. Ostroumov. Translated from *Doklady Akad. Nauk S.S.S.R.* 103, 413-16(1955). 3p. Available from Consultants Bureau (Collection No. 4 of Soviet Research in High Energy Fission), New York.

An experiment has been performed in nuclear emulsion plates irradiated by protons in which the mean excitation energy, U , of Ag and Br nuclei was determined from tracks of recoil nuclei in stars. The value $U = 55$ Mev was determined to within an accuracy of 20%, and the significance of the result is discussed. (M.P.G.)

1018

AN ISOMER OF Rh^{106} . G. B. Baro, W. Seelmann-Eggebert, and I. Zabala. *Publ. com. nacl. energia atomica* (Buenos Aires), Ser. quim. 1, No. 4, 29-41(1955). (In Spanish)

A new rhodium activity of 117-minute half life was found. It is formed by (n, p) , (n, α) and d, α reaction, but not as a normal fission product or as a daughter of Ru^{106} . The maximum energy of the negatrons emitted is 0.7 Mev. The total disintegration energy Q is about 3.6 Mev. The mass number of the new rhodium activity is 106, probably a higher isomer of the known 30-second Rh^{106} . The newly found Rh^{106m} does not disintegrate by gamma rays ($<1\%$) to the normal state of Rh^{106} . It emits the same gamma rays as the 30-second Rh^{106} and the Ag^{106} , as well as other gamma lines. (auth)

1019

ON A NEW METHOD OF OBTAINING THE LEVELS OF NUCLEAR ROTATION. Claude Marty. *Compt. rend.* 241, 928-9(1955) Oct. 10. (In French)

The symmetry properties of wave functions have been studied. For the case of strong coupling, a zero order approximation is defined which introduces a new numerical quantity $|K|$. The rotational spectra can then be obtained whether or not the nuclei have an axis of symmetry. (tr-auth)

1020

PRELIMINARY RESEARCH ON THE X RAY SPECTRA OF ALLOYS IRRADIATED WITH FAST NEUTRONS. Yvette Cauchois. *Compt. rend.* 241, 942-4(1955) Oct. 10. (In French)

The K absorption spectrum of nickel, from thin foils of nickel alloys containing 5% copper, seems to be modified when the foils have received fast neutron doses of the order of 10^{19} neutrons/cm². (tr-auth)

1021

THEORY OF PHOTONUCLEAR REACTIONS. I. NUCLEAR MODEL. Andre Herpin and Claude Mercier. *Compt. rend.* 241, 947-9(1955) Oct. 10. (In French)

In view of its use in the theory of photonuclear reactions a nuclear model with a complex potential has been studied. Its energy spectrum has been determined, and it is shown that, for a particular choice of potential, the equivalent of a black nucleus for certain discrete energy values is obtained. (tr-auth)

1022

THE ISOMERS OF ^{180}Os AND ^{180}Ir . A. H. W. Aten, Jr., G. D. De Feyfer, M. J. Sterk, and A. H. Wapstra (Institut voor Kernfysisch Onderzoek, Amsterdam, Netherlands). *Physica* 21, 740-2(1955) Sept. (In English)

Metallic Ir was bombarded by fast neutrons, and after chemical purifications, half lives of 3 hrs and 11 days

were found, in addition to 72-day Ir^{182} . These were assigned as isomeric states of Ir^{180} , since Chu found 3-hr Ir^{180} after irradiating Os with deuterons. The main γ rays which occurred in the 3-hr Ir^{180} were also observed—with roughly the same intensities—in a 10-min. Os isomer. A partial decay scheme is presented. (L.M.T.)

1023

THEORY OF THE EFFECT OF NUCLEON-NUCLEON CORRELATIONS ON THE SCATTERING OF HIGH ENERGY ELECTRONS OR MUONS BY NUCLEI. R. Gatto (Univ. of Rome). *Nuovo cimento* (10) 2, 669-76(1955) Sept.

1024

SPIN-ECHO MODULATION DUE TO MAGNETIC DIPOLE INTERACTION BETWEEN A CLOSELY INTERACTING PAIR OF NUCLEI IN CRYSTALS. T. P. Das and S. K. Ghosh Roy (Institute of Nuclear Physics, Calcutta, India). *Indian J. Phys.* 29, 272-8(1955) June.

It is shown that the strong interaction between a closely interacting pair of nuclei subject to resonance simultaneously produces a modulation of the spin-echo pattern for these nuclei. Methods for obtaining information regarding the structure of the crystal from an analysis of this modulation pattern is discussed. (auth)

1025

A NOTE ON THE GROUND STATE SPIN OF ^{177}Hf . B. Hartmann and T. Wiedling (Univ. of Stockholm, Sweden). *Phil. Mag.* (7) 46, 1139-41(1955) Oct.

An attempt was made to determine the ground state spin of Hf^{177} through angular correlation measurements. Results indicate that this method is not sufficient for definite conclusions. (D.E.B.)

1026

INVESTIGATION OF SPIN-ORBIT TYPE SPLITTING OF He^5 LEVELS IN SCATTERING OF POLARIZED NEUTRONS BY He^4 . I. I. Levintov, A. V. Miller and V. N. Shamshev. (Inst. Chemical Physics). *Doklady Akad. Nauk S.S.S.R.* 103, 803-6(1955) Aug. 11. (In Russian)

Refer also to abstracts 957, 1107, 1109, 1110, 1123, and 2301.

NUCLEAR REACTORS

1027 AECD-3678

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

OPERATING MANUAL FOR THE MTR. SECTION TWO—EXCLUSION AREA MATERIALS TESTING REACTOR. Dec. 1953. Decl. with deletions Aug. 22, 1955. 386p. Contract AT(10-1)-205.

Descriptions and operating procedures are given of the Materials Testing Reactor, the reactor control system, the process water system, the heating and ventilation systems, the air systems, the canal, the experimental facilities, monitoring systems, and the effluent control system. (B.J.H.)

1028 AECU-3108

Knolls Atomic Power Lab., Schenectady, N. Y. RATES OF CONVERGENCE IN NUMERICAL SOLUTION OF THE DIFFUSION EQUATION. R. H. Stark. [1954?]. 19p. Contract [W-31-109-Eng-52].

Calculation of neutron flux and power distribution is

described for a reactor model in which there is variation of composition with respect to 2 space dimensions. The method has been found to be workable although costly. Suggestions are given for reducing the cost and increasing the convenience of the program. (M.P.G.)

1029 ANL-5491

Argonne National Lab., Lemont, Ill. and Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

JOINT STATUS REPORT ON FAST REACTOR PHYSICS. D. Okrent and L. S. Shepherd. Oct. 1955. 3p. Contract W-31-109-eng-38.

The status of fast reactor physics in the United Kingdom and U. S. has been examined. Substantial agreement was found in experimental and theoretical values of breeding ratio and other figures. (M.P.G.)

1030 BNL-357

Brookhaven National Lab., Upton, N. Y.
THE TEMPERATURE-DEPENDENT KINETICS OF CIRCULATING FUEL REACTORS. J. A. Fleck, Jr. July 1955. 19p.

The kinetic behavior of circulating fuel reactors under conditions of constant inlet temperature can be formulated in terms of partial differential equations in time and displacement along the core axis. By means of a Fourier expansion of the flux these equations can be reduced to an infinite system of integro-differential equations of "delay" type in the Fourier amplitudes. From the boundedness and nonperiodicity of the solutions to these equations it is surmised that the oscillations of the system damp. When the flux is approximated by a single Fourier harmonic, the system reduces to a single equation. For small amplitudes of oscillation and for certain values of the parameters there exist periodic solutions to this equation. Univac solutions of the partial differential equations show that for these parameter values even large amplitude oscillations are weakly damped. (auth)

1031 BWR-5

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

USEFUL FORMULAE FOR BOILING REACTORS. B. L. Goodlet. Sept. 9, 1955. 8p.

Formulas are derived for the heat output from a fuel element duct, steam voidage at duct exit, heat output when limited by voidage, and pressure drop due to acceleration. A table of useful quantities for boiling core calculations is presented. Comments are included on alternative designs using light or heavy water, limiting heat flux, limiting steam content of core, and relations between reactivity and tank pressure. (M.P.G.)

1032 HW-21793

Hanford Works, Richland, Wash.

HANFORD STANDARD PILE. D. E. Davenport, G. L. Lynn, and D. C. Pound. July 30, 1951. Decl. July 27, 1955. 27p. Contract W-31-109-Eng-52.

The construction, and diffusion length measurements in the Hanford Standard pile are described. The techniques used for accurate flux measurement are given, and the importance of the potential errors discussed. The steps in the calculation of diffusion length from those measurements using the conventional thermal-source approximation and the fast-source theory are outlined, and a comparison is made of the diffusion lengths so calculated. It is con-

cluded that the fast-source theory is preferable, but only when a single-source was used rather than two or four matched sources did the diffusion length obtained from thermal-source theory differ appreciably from that obtained by fast-source calculations. (auth)

1033 HW-29748

Hanford Atomic Products Operation, Richland, Wash.
DIFFUSION LENGTH MEASUREMENTS IN THE $7\frac{1}{2}$ " LATTICE EXPONENTIAL PILE. C. R. Richey. Oct. 26, 1953. Decl. Aug. 22, 1955. 12p. Contract W-31-109-Eng-52.

The correction factors for absorption in aluminum and for reduction in graphite density caused by holes, applied in determining the diffusion length, were investigated in an exponential pile with the metal removed. The effect of neutron streaming in the process tubes was also investigated. It is concluded that the correction factors are correct and that no effect of neutron streaming in the process tubes is evident. (auth)

1034 HW-38876

Hanford Atomic Products Operation, Richland, Wash.
HIGH PRESSURE LOOP DESIGN FOR STUDIES OF REACTIONS BETWEEN HEATED METALS AND HIGH TEMPERATURE WATER. D. C. Kaulitz and J. E. Minor. Sept. 9, 1955. 20p. Contract W-31-109-Eng-52.

A high pressure facility has been constructed to study the reactions between high temperature water and metal specimens heated well above water temperature. Location of the reaction chamber in a bypass section cut off from the loop proper by two air-operated valves permits the specimen to be protected by an inert atmosphere while the water is heated. Water temperatures and pressures up to 300°C and 2000 psi and specimen temperatures up to 800°C are utilized. (auth)

1035 IDO-16014

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SHIELDING CALCULATIONS FOR COFFINS FOR VERTICAL HOLE PLUGS. J. W. Webster. May 9, 1952. Decl. Sept. 12, 1955. 14p. Contract [AT(10-1)-205].

1036 IDO-16020

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PERTURBATIONS ARISING FROM A CADMIUM WRAPPER ON THE HB-3 PLUG. H. L. McMurtry. Sept. 10, 1952. Decl. Sept. 12, 1955. 11p. Contract [AT(10-1)-205].

Experiment ORNL-2a requires that the HB-3 plug of the Materials Testing Reactor be wrapped in 40-mil Cd beginning 1 ft away from the active lattice. The calculations reported here provide an estimate of the flux distribution near the plug and show that the reactivity will be changed by about 0.03%. (auth)

1037 IDO-16026

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTIVITY LOSSES IN THE FIRST 3×9 LOADING OF THE MTR. J. W. Webster. Aug. 13, 1952. Decl. Sept. 28, 1955. 11p. Contract [AT(10-1)-205].

It is found that the reactivity losses due to fission product poisons and fuel burn-up amount to 10.6% and that due to temperature effects is 0.3% making a total of 10.9%. This differs by 0.9% from the experimental value of 11.8% obtained for the available excess reactivity contained in

the reactor at start-up. The value used for the cross section per fission, σ_p , of the low cross section fission products was taken as 50 barns. There is apparently considerable uncertainty as to the proper value for this constant. If a value of 100 barns is used (which is not unreasonable), the calculated reactivity losses are in good agreement with the experimental figure for the excess reactivity available at the start-up. However, it is felt that these results should not be taken too seriously as an indication of the proper value for σ_p until more accurate calculational methods have been applied, particularly with respect to the weighting functions, and until theoretical results have been compared with experiment on several loadings. (auth)

1038 IDO-16031

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SOME APPROXIMATIONS INVOLVED IN THE CALCULATIONS OF THE MTR REACTIVITY. H. L. McMurry. Oct. 2, 1952. Decl. Sept. 12, 1955. 13p. Contract [AT(10-1)-205].

Some approximations inherent in the calibration equation, whereby the excess reactivity of any MTR loading is determined from the effect of adding uniformly distributed poison, are examined. It is concluded that the excess reactivities obtained from the calibration data may be several per cent too high. Part of the discrepancy between the "calibration" value of 11.8% for the first 3×9 loading and the 10.9% calculated from experimental flux plots and weight factors (a difference of over 10%) might be accounted for in this way. (auth)

1039 IDO-16035

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR OPERATING POWER—PRELIMINARY INVESTIGATION. J. R. Huffman and C. F. Leye. Oct. 20, 1952. Decl. Sept. 12, 1955. 13p. Contract [AT(10-1)-205].

In past operations, the power level of the MTR has been increased gradually as the level of the shim rods was raised. This resulted in a relatively short operating period at full power, 30 Mw, for any one loading. An investigation was started to determine the extent to which the reactor could operate at full power a greater proportion of the time. Preliminary results indicate that it is permissible to raise the reactor power level to 30 Mw when the shim rods have reached the 17-in. level. This power level is based on the premise that film boiling is not permitted in the active lattice. Data are presented on the temperature rise of water through fuel elements and pressure differences in the reactor tank. (M.P.G.)

1040 IDO-16071

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PERMISSIBLE MTR LEVELS FOR VARIOUS SHIM ROD POSITIONS (WITHOUT FILM BOILING). C. F. Leye. Feb. 19, 1953. Decl. Sept. 12, 1955. 6p. Contract AT(10-1)-205.

The maximum permissible power levels of the MTR were determined for the lowest shim rod positions. These values can be increased as the shim rods are raised during a normal operating cycle. If the inlet water temperature can be maintained at 100°F the power can vary from 42 to 87 megawatts as the shim rod positions are raised from 14" to 30". It is emphasized that these calculations

are associated only with the heat removal from the active core. They do not consider the capacity of the cooling water system, corrosion, stress in the Be, and heat problems in the experimental equipment. These must be taken into account before final decision is made to operate at powers above 40 megawatts. (auth)

1041 IDO-16075

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REFLECTOR SAVINGS DUE TO THE MTR WATER BLANKET. M. L. Batt, J. W. Webster, and H. L. McMurry. Feb. 20, 1953. Decl. Sept. 12, 1955. 16p. Contract AT(10-1)-205.

Critical masses and flux distributions for the actual geometry of the MTR are too complex to calculate because of the difficulty in satisfying the boundary conditions. Calculations are made on reactors with simple geometries which simulate the MTR. One approximation which is usually made is to replace the water blanket above and below the core by a vacuum. The core height must then be increased by an amount equal to the reflector savings. A distance equal to the reflector savings due to the water blanket above and below the MTR core plus the extrapolation distances at the bare boundaries was estimated, by analysis of experimental flux plots obtained by G. O. Bright and F. Schroeder, on all the fuel elements. An average of 17.4 cm was obtained for this length. (auth)

1042 IDO-16083

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CALCULATED REACTIVITY CHANGES DUE TO REDUCTION OF ALUMINUM IN THE MTR CORE. H. L. McMurry. Mar. 16, 1953. Decl. Sept. 12, 1955. 16p. Contract AT(10-1)-205.

The change in reactivity for departures of the aluminum-water ratio in the MTR core from 0.732 (the value for the 3×9 loadings up to loading No. 10) has been calculated over the range of Al/H₂O ratio from 0.58 to 0.80. (Al/H₂O ratios are those for the core with shims fully withdrawn.) Using these data a reactivity increase of 0.84% in $\Delta k/k$ is predicted for an Al/H₂O ratio of 0.664 which is valid for charge number 10. This charge employs fuel elements differing from those used previously in having aluminum side walls reduced to $\frac{1}{8}$ " thick from the previous $\frac{3}{16}$ " thickness. A reactivity increase of 2% is predicted for an Al/H₂O ratio of 0.581, which corresponds to the use of some proposed 19-plate fuel assemblies. These assemblies would have plates clad with a total thickness of 0.030" of aluminum instead of the 0.040" now used and would have $\frac{1}{8}$ " side walls. (auth)

1043 IDO-16093

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

GAMMA HEATING MEASUREMENTS IN THE MTR. C. H. Hogg. Sept. 23, 1953. Decl. Aug. 31, 1955. 11p. Contract AT(10-1)-205.

1044 IDO-16125

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

5 X 5 REACTOR LOADING—NUCLEAR CALCULATIONS FOR A CYLINDRICAL APPROXIMATION. G. H. Hanson, L. H. Boyer, and H. L. McMurry. Oct. 1, 1953. Decl. Sept. 12, 1955. 16p. Contract AT(10-1)-205.

Prior to operations with the second MTR fuel charge, it

was established experimentally that approximately 990 cm^2 (for thermal neutrons) of uniformly-distributed poison (as silver and gold wires) were required to poison completely a 5×5 lattice consisting of 140-gram fuel assemblies and 109-gram shim rods. It was later established that lithium poison was present from the brazing flux, possibly to the extent of 190 cm^2 . The resulting experimental k_{∞} was 1.369 (including the lithium). Nuclear constants were developed for this situation, and the calculated two-group k_{∞} for a cylindrical reactor with the same cross sectional area and height as the 5×5 was 1.336. The discrepancy (1.369 as compared to 1.336) can be explained in part because the geometry of the cylindrical approximation is superior to that of the square lattice arrangement. The differences between the calculated flux distribution and k_{∞} values for the poisoned-down core with and without lithium were insignificant. Flux distributions, adjoint functions, and weighting factors are given for the cylindrical reactor with no lithium present. (auth)

1045 IDO-16127

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

NUCLEAR CONSTANTS FOR THE MTR AS A FUNCTION OF FUEL CONTENT, POISON CONTENT, AND $\text{Al}/\text{H}_2\text{O}$ RATIO. H. L. McMurtry. Oct. 23, 1953. Decl. Sept. 12, 1955. 17p. Contract AT(10-1)-205.

Nuclear constants are needed for the clean core containing 140-gram fuel assemblies and 109-gram shim fuel sections with and without the effect of added poison, in order to compare calculated and observed excess reactivities and critical masses for the fuel loadings investigated during start-up. To calculate the effect of changing the aluminum-water ratio in more recent loadings employing 168-gram fuel assemblies and 131-gram shim fuel sections constants are needed for several other situations. Calculations of, and values for, the age at thermal energy (τ), diffusion length squared (L^2), slow and fast diffusion constants (D_s , D_f), total macroscopic cross section (Σ_a), macroscopic cross section for U^{235} (Σ_u) and reproduction constant (k_{∞}) for the important cases are given. The results are summarized. (auth)

1046 IDO-16131

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PROPOSAL FOR A REACTIVITY MEASUREMENT FACILITY. Supplement I. Sept. 30, 1953. Decl. Sept. 12, 1955. 8p. Contract AT(10-1)-205.

The Reactivity Measurement Facility is a proposed reactor designed to provide experimental evaluation of fuel rods, fuel-rod geometries, and other factors affecting the reactivity of the Materials Testing Reactor. This report deals with fuel handling problems, reactor operation including startup, operation, shutdown, and experimentation, products disposal, and safety hazards. (K.S.)

1047 IDO-16133

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTIVITY EFFECT OF REDUCING THE $\text{Al}/\text{H}_2\text{O}$ RATIO IN THE MTR CORE. J. W. Webster. Oct. 26, 1953. Decl. Sept. 12, 1955. 18p. Contract AT(10-1)-205.

The effect on the reactivity of the MTR of reducing the $\text{Al}/\text{H}_2\text{O}$ ratio in the core has been calculated to be approximately a linear function of the $\text{Al}/\text{H}_2\text{O}$ ratio. The results of calculations for a 6×5 MTR loading are presented. New

values were obtained for the average fast group diffusion coefficient, D_f , by weighting $D(E)$ over a calculated above-thermal MTR flux spectrum. The D_f was found to be a linear function of the $\text{Al}/\text{H}_2\text{O}$ ratio. (M.P.G.)

1048 IDO-16136

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ESTIMATED REACTIVITY OF THE MTR SHIM-SAFETY CONTROL RODS. J. W. Webster. Nov. 18, 1953. Decl. Aug. 31, 1955. 18p. Contract AT(10-1)-205.

Modification of the MTR fuel element design has been under consideration. This has required a further evaluation of the safety margin in the shim control. For this reason, calculations have been made of the reactivity effect of the shims for several possible MTR loading configurations. Based on Nordheim-Scalettar type calculations, the potential reactivity effect of the MTR shim-safety control rods are estimated. (auth)

1049 IDO-16140

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ESTIMATION OF FUEL REQUIREMENTS FOR TWO WEEK CYCLES ON THE MTR. H. L. McMurtry. Dec. 2, 1953. Decl. Sept. 15, 1955. 19p. Contract AT(10-1)-205.

A method has been devised for predicting the minimum number of new fuel assemblies required to keep the Materials Testing Reactor operating for 2 weeks at 30 Mw when a 3×9 slab loading is used. It is estimated that the life of a charge can be predicted to within 15 Mw provided changes in experiments do not affect the reactivity. (M.P.G.)

1050 IDO-16155

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FLUX DISTRIBUTIONS, ADJOINT FUNCTIONS AND WEIGHTING FACTORS FOR THE MTR WITH 5×6 LOADINGS. A. V. Grimaud and H. L. McMurtry. Feb. 23, 1954. Decl. Sept. 12, 1955. 47p. Contract AT(10-1)-205.

When the operation of the MTR with a 5×6 core configuration was proposed, it was decided to calculate the fast and slow neutron fluxes and their adjoints. These are needed to give estimates of fluxes, reactivity perturbations, and to calculate fuel requirements to give fixed periods of operation. Calculated fast (above thermal) and slow (thermal) fluxes together with the corresponding adjoint functions are presented for the MTR with a 5×6 core configuration. The fuel and poison weighting factors for the core lattice positions are tabulated. A thermal flux map (based on these calculations) of the tank section is presented. In the computations, a rectangular geometry is considered and each function; slow flux (ϕ_s), fast flux (ϕ_f), slow adjoint flux (ϕ_s^+) and fast adjoint flux (ϕ_f^+) is approximated by the form; $\phi(x,y,z) \approx \phi(x) \cdot \phi(y) \cdot \phi(z)$. In this expression x , y and z are a set of orthogonal axes, each axis being normal to one pair of core faces. Some error is introduced by assuming separability; however, similar calculations for the 3×9 core proved quite valuable and it is felt that the 5×6 data have merit also. The detailed theory is presented in an Appendix. (auth)

1051 IDO-16186

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FLUX DISTRIBUTIONS, ADJOINT FUNCTIONS AND WEIGHTING FUNCTIONS FOR THE MTR WITH 5×5

LOADINGS. A. V. Grimaud. July 26, 1954. Decl. Sept. 28, 1955. 16p. Contract AT(10-1)-205.

The problem of calculating reactivity changes due to small changes in reactor composition or structure may be solved by perturbation methods. These solutions require the calculated fast and slow neutron flux and adjoint flux distributions. Flux distributions as calculated for the 5×5 configuration are presented. The tabulated fuel and poison weighting functions are also presented for each of 216 core positions, i.e., each fuel assembly is subdivided into eight vertically distributed cells. The computations were based upon two group diffusion theory for a rectangular geometry. This method makes use of the approximation that the fluxes at a point may be separated into components along three orthogonal axes (x, y, and z), each axis being normal to one pair of core faces. The flux at a point is given by $\varphi(x,y,z) = \varphi(x) \cdot \varphi(y) \cdot \varphi(z)$. (auth)

1052 IDO-16187

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTIVITY CHANGES DURING MTR OPERATION. H. L. McMurtry, A. V. Grimaud, and G. H. Hanson. Sept. 15, 1954. Decl. Sept. 28, 1954. Decl. Sept. 28, 1955. 15p. Contract AT(10-1)-205.

Two methods for comparing reactivity changes associated with poisoning experiments on MTR cores with those obtained from operating data on the same cores were described. Results calculated on both methods for the cores used in charges 1, 2 and 4 are reported. For each method the reactivity change due to burnout and fission poison production agrees with the change associated with uniform poison addition to within the uncertainties which might be expected because of the approximations involved in the methods, and the errors in the data. The contribution of the low cross section fission products has been calculated by assigning 50 b of low cross section poisons per fissioned nucleus, and by a more elaborate method of Webster which takes into account the cross sections, half lives, etc., of the individual fission products. However, the reactivity change due to low cross section fission products is too small compared to that due to burnup and Xe and Sm to permit a choice between the two ways of evaluating the effect of low cross section poisons. (auth)

1053 IDO-16200

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

INTEGRATED FAST FLUX DISTRIBUTION IN SEVERAL MTR EXPERIMENTAL FACILITIES. E. Fast. Nov. 29, 1954. Decl. Aug. 26, 1955. 27p. Contract AT(10-1)-205.

The distribution of graphite-damaging nvt is presented as a series of curves for the MTR experimental facilities. The position of maximum intensity usually occurs within 5 inches below centerline of the reactor. The relative intensities at maximum is given in terms of fast nvt per MWD operation of the reactor. (auth)

1054 IDO-16249

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTIVITY CHANGES DUE TO LOCALIZED PERTURBERS IN THE MTR WITH 3×9 SLAB CONFIGURATION. H. L. McMurtry. Sept. 16, 1954. Decl. Aug. 26, 1955. 13p. Contract AT(10-1)-205. (MTRL-54-91)

Estimates of reactivity changes due to localized pertur-

bations in the MTR are considered. Equations for rapidly calculating effects due to changes in absorption, age, and diffusion coefficients are given. Illustrative examples are provided. (auth)

1055 IGR-R/R-151

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

VARIATIONAL PRINCIPLES FOR TWO GROUP DIFFUSION THEORY. PART 1. BARE SYSTEMS. R. T. Ackroyd. Sept. 27, 1955. 9p. (WHC(C)/P53).

1056 KAPL-41

[Knolls Atomic Power Lab., Schenectady, N. Y.]. ON THE ACCURACY OF TWO GROUP EQUATIONS. D. M. French and H. Hurwitz, Jr. Mar. 5, 1948. Decl. Oct. 6, 1955. 21p.

The accuracy of results in 2-group reactor calculations has been investigated by comparison with more accurate results. The comparison was made for piles consisting of a core and reflector with equal mean free paths and equal slowing down power. It is assumed that there is no absorption in the reflector. The comparisons are presented in graphical form. (M.P.G.)

1057 KAPL-58

[Knolls Atomic Power Lab., Schenectady, N. Y.]. NUCLEAR ENGINEERING COURSE, 1947-1948. ASSIGNMENT VII—SOLUTION. Apr. 15, 1948. Decl. Oct. 18, 1955. 13p.

Solutions are presented to the problems stated in KAPL-29 on the diffusion equation, critical radius, neutron density, and reactivity of a cylindrical bare pile. (M.P.G.)

1058 KAPL-813

Knolls Atomic Power Lab., Schenectady, N. Y. SOME ACTIVATION MEASUREMENTS IN THE INTERMEDIATE ENERGY REGION. I. H. Dearnley, H. E. Soisson, and J. E. Yunker. Sept. 24, 1952. Decl. Oct. 18, 1955. 88p. Contract W-31-109-Eng-52.

Measurements of ratios of isotopic capture cross section to U^{235} fission cross section (σ_a/σ_{f235}) in an intermediate energy region have been made for a number of isotopes. Materials were activated by photoneutrons from a 2-Mev x-ray Be block source or by neutrons from side hole No. 6 of the Argonne CP-3 reactor. The ratio of σ_a/σ_{f235} was measured for Na^{23} , Mn^{55} , As^{75} , Rb^{85} , Sr^{88} , Zr^{90} , Mo^{98} , Ru^{102} , Pd^{108} , Cd^{114} , In^{115} , Sn^{120} , Sn^{122} , Sn^{124} , Sb^{123} , Ba^{138} , La^{139} , Pr^{141} , Ce^{142} , Nd^{148} , W^{186} , and Au^{197} . The values obtained were considerably lower than predicted by the statistical theory of nuclei. (auth)

1059 NP-5686

[Aktiebolaget Atomenergi, Stockholm]. THE ASEA REACTOR. Appendix No. 1. [nd]. 6p., 2 illus.

Blueprints and cost estimates are given for a natural U, heavy-water moderated or an enriched U graphite-moderated reactor. The designs given are for a unit cooled with either liquid Na or He gas. (B.J.H.)

1060 RDB(R)/8150

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England. A RAYLEIGH-RITZ PROCEDURE FOR ESTIMATING THE CRITICAL LAPLACIAN OF ONE GROUP DIFFUSION THEORY. R. T. Ackroyd. Sept. 22, 1955. 16p. (WHC(C)/P.38)

A Rayleigh-Ritz procedure is given for estimating the

critical Laplacian of a reflected fissile body according to one group diffusion theory. The procedure gives also an approximation for the neutron flux distribution. A simple example indicates that an accuracy of a few per cent can be achieved with very little work. If necessary the procedure can be used to give an approximate value of the critical Laplacian to any desired degree of accuracy. (auth)

1061

HYDRAULIC CONTROL-DRIVE MECHANISMS. Charles M. Rice (Ford Instrument Co., Long Island City, N. Y.) *Nucleonics* 13, No. 11, 116; 118; 120; 122; 124; 126-7(1955) Nov.

Designs and figures of actuators for hydraulic reactor-control assemblies are given. The operation of such a system is discussed. (B.J.H.)

1062

THERMAL BUCKLING OF A ROD HEAT SOURCE IN A TUBULAR COOLANT DUCT. C. E. Iliffe (United Kingdom Atomic Energy Authority, Risley, Lancs, England). *J. Nuclear Energy* 2, 1-14(1955) Aug.

An analysis is made of the bending of a rod heat source in a tubular coolant duct due to any initial bend in the rod and to the irregular thermal effects such bending produces. For the case in which the mean clearance of the rod in the duct is sufficiently high, the analysis can be simplified to express the maximum bend in terms of a single parameter, B , the "thermal buckling factor." At a critical value of B the rod is shown to buckle without limit. (auth)

1063

THE SIGNIFICANCE OF WETTING IN REACTOR TECHNOLOGY. J. W. Taylor (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 2, 15-30(1955) Aug.

The fundamental forces responsible for the spreading of a liquid metal on a solid (or a liquid) surface are discussed, and a number of interfacial tension and spreading studies are analyzed in terms of the theoretical considerations. In the light of these, methods of modifying the interfacial tension in any given application are suggested. The significance of interfacial effects in the following technological processes is outlined: liquid metal corrosion and intergranular penetration; heat transfer; mass transfer and zone melting; liquid metal slurry properties and stability; and extraction metallurgy. (auth)

1064

A MODIFICATION TO THE DIFFUSION THEORY OF THE THERMAL FINE STRUCTURE IN A REACTOR TO ACCOUNT FOR THE EFFECT OF AIR CHANNELS. D. A. Newmarch (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 2, 52-8(1955) Aug.

The ratio R of the thermal neutron flux at the air/moderator interface to the flux at the air/metal interface is calculated for the cases of uranium rods of radius a set in air channels of radius c , and uranium tubes of inner radius g , outer radius a set in air channels of radius c . (auth)

1065

THE SPECIFICATION OF NEUTRON FLUX AND NUCLEAR CROSS-SECTIONS IN REACTOR CALCULATIONS. Carl H. Westcott (Atomic Energy of Canada Ltd., Chalk River, Ont.). *J. Nuclear Energy* 2, 59-76(1955) Aug.

The concepts of the "flux" of neutrons and the target area or "cross-section" to be associated with a particular

nucleus are familiar and convenient for calculating the rate at which a specified nuclear reaction will occur. Complexities arise when, as in a thermal reactor, the neutrons vary widely in velocity, since the cross-section also varies with this velocity. These problems are examined and consideration is given to how an "effective" cross-section may be defined. It is noted that reactor flux is commonly stated in terms of the neutron density (number per unit volume) multiplied by a conventional velocity (2200m/sec). The true flux differs from the value normally used by a numerical factor. Although one could avoid the difficulty by working in terms of neutron density instead of flux and replacing cross-section by a new concept, the well established conventions appear worth preserving. Formulas are given for "effective" cross-sections applicable to thermal reactor neutron spectra for a reaction having a simple Breit-Wigner resonance, with numerical examples, and the effect of varying the neutron temperature is considered. (auth)

1066

THERMONUCLEAR POWER REACTORS—ARE THEY FEASIBLE? Hans Thirring (Univ. of Vienna, Austria). *Nucleonics* 13, No. 11, 62-6(1955) Nov.

The source of stellar energy and various fusion reactions are reviewed. Explosive and controlled reactions in nuclear fusion are also discussed. (B.J.H.)

1067

TEST TUBE RESEARCH REACTOR. Harold M. Busey and R. Philip Hammond (Los Alamos Scientific Lab., N. Mex.). *Nucleonics* 13, No. 11, 72-5(1955) Nov.

Designs are given for a modified water-boiler-type research reactor, the Test Tube Reactor. The lower portion of the container is filled with a uranyl sulfate or phosphate solution and also holds a heat exchanger. The upper portion forms a sealed gas recombiner, thus eliminating the stack problem. A central flux of 5×10^{12} n/cm²/sec can be attained at 100 kev. (B.J.H.)

Refer also to abstracts 884, 947, 1000, 1001, 1002, and 1087.

NUCLEAR TRANSFORMATION

1068 AEC-tr-2305

INVESTIGATIONS OF THE (γ, p) REACTION IN COPPER. E. M. Leikin, R. M. Osokina, and B. S. Ratner. Translated from *Doklady Akad. Nauk S.S.S.R.* 102, 245-8 (1955). 3p. Available from Consultants Bureau, New York.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-5508.

1069 AEC-tr-2306

INVESTIGATION OF THE (γ, p) REACTION IN NICKEL. E. M. Leikin, R. M. Osokina, and B. S. Ratner. Translated from *Doklady Akad. Nauk* 102, 493-4(1955). 2p. Available from Consultants Bureau, New York.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-5779.

1070 AEC-tr-2307

FISSION OF URANIUM NUCLEI BY PROTONS WITH AN ENERGY OF 460 MEV. N. S. Ivanov, N. A. Perfilov, and V. P. Shamov. Translated from *Doklady Akad. Nauk*.

S.S.S.R. 103, 573-6(1955). Available from Consultants Bureau (Collection No. 4 of Soviet Research in High Energy Fission), New York.

The fission cross section of U for 460 Mev protons was determined as 1.2 ± 0.3 b. Angular and energy distribution of fission particles were analyzed. (D.E.B.)

1071 AEC-tr-2308

MECHANISM FOR THE FISSION OF HEAVY NUCLEI AT HIGH EXCITATION ENERGIES. V. P. Shamov. Translated from Doklady Akad. Nauk S.S.S.R. 103, 593-5(1955). 3p. Available from Consultants Bureau (Collection No. 4 of Soviet Research in High Energy Fission), New York.

Protons of 460 and 660 Mev energies were used in the study of heavy nuclei fission mechanisms. Angular and energy distribution of emitted charged particles, mean excitation energies, fission cross sections, and the average number of particles emitted per fission were determined for Bi, W, and U. (D.E.B.)

1072

ZINC 60 AND ZINC 61. L. Lindner and G. A. Brinkman (Instituut voor Kernfysisch Onderzoek, Amsterdam, Netherlands). *Physica* 21, 747-8(1955) Sept. (In English)

From the experiments performed, it was concluded that Zn^{60} and Zn^{61} are formed by the reactions $Ni^{58}(\alpha, n)$ and $Ni^{58}(\alpha, 2n)$, respectively, with perhaps some $Ni^{60}(\alpha, 3n)Zn^{61}$. The half life of Zn^{60} was found to be 2.1 ± 0.1 min., and that of Zn^{61} to be 87 ± 3 sec. Zn^{61} was found to emit positrons of $E_{max} = 4.8 \pm 0.3$ Mev. Weak γ rays between 0.5 and 3.0 Mev were found, but couldn't be assigned. (L.M.T.)

1073

PHOTOFISSION OF URANIUM NUCLEI WITH THE EMISSION OF THE LIGHT LONG-RANGE PARTICLE. B. P. Bannik and Yu. S. Ivanov (Lebedev Physics Inst.). Doklady Akad. Nauk S.S.S.R. 103, 997-9(1955) Aug. 21. (In Russian)

Nuclear emulsions were used to observe the fission of uranium nuclei effected by photons of high energies 80 and 150 to 250 Mev. Experiments with energies over 150 Mev indicated an escape of a third light, charged, long-range particle which the authors named "triple fission." A table of triple fission frequency with energies of 150 to 250 Mev is given. As the process of triple fission in uranium with high energies $E_\gamma > 150$ Mev the authors consider as follows: in the uranium nucleus a photon creates a meson (π^+ , π^- , or π^0) which is absorbed by inner nucleons of the nucleus, and as a result of absorption a small tightly bound group of nucleons (or possibly one separate nucleon) obtain sufficient energy to escape out of the nucleus as a separate particle. Angular distribution of the triple fission long-range particles is given in support of the theory. (R.V.J.)

Refer also to abstracts 984, 1004, 1145, and 1149.

PARTICLE ACCELERATORS

1074 AERE-GP/R-1613

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DESIGN NOTES ON RESONATORS FOR PROTON LINEAR ACCELERATORS. J. J. Wilkins. Mar. 21, 1955. 27p.

Basic data and methods which have been used in designing Berkeley-type r-f resonators suitable for accelerating protons to over 100 Mev are summarized. Comprehensive data are given on resonant dimensions,

shunt impedances, and Q values, both for single re-entrant cavity resonators and for complete Berkeley-type resonators. Transit-time effects, r-f breakdown limitations, and the use of localized tuners are among the further topics treated. (auth)

1075 AERE-T/M-128

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FOCUSING IN THE PROTON LINEAR ACCELERATOR: II. M. Bell. July 1955. 13p.

Calculations of the detailed distribution of focusing and defocusing forces (both static and r-f) over a period of the waveguide are given. A comparison with previous calculations in which the detailed distribution was replaced by a smoothed out distribution with the same average value is made. It is found that the smoothed out theory is adequate for most purposes. (auth)

1076 CERN-PS/MM-21

[European Organization for Nuclear Research, Geneva. Proton Synchrotron Group].

MESURES DYNAMIQUES SUR LES MODELES AC V ET AC VI. (DYNAMIC MEASUREMENTS ON MODELS AC V AND AC VI). Sept. 1955. 29p.

Dynamic measurements were made in CERN proton-synchrotrons. Included are measurements of the central plane, of the influence of metallic objects placed around the magnets on the magnetic field, of n near the vertical walls of the vacuum chamber in inoxidizable steel, of the Foucault currents in the conductors of the excitation coils, of the distribution of B along the magnet, of the leakage flux for model AC VI, and a comparison of B in models AC V and AC VI fed in series. (B.J.H.)

1077 CERN-PS/MM-22

[European Organization for Nuclear Research, Geneva. Proton Synchrotron Group].

ETUDE DES TENSIONS D'ALIMENTATION DE L'AIMANT DU SYNCHROTRON A PROTONS. (Study of the Supply Voltages of the Magnet of the Proton Synchrotron). Oct. 1955. 12p.

1078 CERN-PS/PL-5

[European Organization for Nuclear Research, Geneva. Proton Synchrotron Group].

INJECTION DANS LE SYNCHROTRON. NOUVEAU SCHEMA DE DEFLECTION. (Injection in the Synchrotron. New Deflection Scheme). P. Lapostolle. Aug. 1955. 10p.

A discussion is given of the deflection scheme which must be used when introducing a beam of particles into the CERN proton-synchrotron. Such a deflection scheme reduces aberration effects and avoids the loss of particles in the beam. Forbidden and satisfactory beam injection regions are discussed. (B.J.H.)

1079 ML-274

Stanford Univ., Calif. Microwave Lab.

CHOICE OF WAVE LENGTH AND CHARACTERISTIC PARAMETERS IN THE DESIGN OF LINEAR ELECTRON ACCELERATORS. E. L. Chu and E. L. Ginzton. Sept. 1955. 80p. Project NR-022-166. Contract Nonr 225(06).

A discussion is given of the linear electron accelerator design with particular emphasis on the choice of operating wavelength (λ). Only one type of accelerator structure, the disk-loaded waveguide, is considered; but the principles discussed can be applied to other structure types as well. A set of criteria is described for the evaluation or com-

parison of different accelerator designs. One simple design, called the "nominal design" and characterized by the relation $IL = 1.24$ (I being the voltage attenuation constant and L the accelerator length) is discussed in particular detail. It is shown, by actually carrying out various maximizing processes, that the nominal design is in most cases not far different from the optimum design, and can most conveniently be used as a reference of comparison or as a basis for making preliminary designs. The optimum design of a linear electron accelerator varies with the type of radiation required for its application, the electron beam or x-rays or both, and depends on many factors such as the amount of available power, type of feed, the desired degree of phase stability, the limiting size and weight, etc. No definite rule can be laid down for scaling the physical dimensions of the accelerator waveguide according to wavelength, because the method of scaling will necessarily depend on circumstances. Scaling is discussed by four specific relations between the accelerator length and the wavelength, namely, $L \sim \lambda^u$, $u = \frac{3}{2}, 1, \frac{1}{2}$, and 0. This interval of u from 0 to $\frac{3}{2}$ is large enough to cover almost all cases of practical interest. Sample designs are described to illustrate the procedure of scaling. Detailed analysis and design curves are given in separate appendices. Appendix A discusses the shunt impedance and related characteristics, B beam loading, and C the characteristic derivatives for determining dimensional tolerances. Each appendix is in sufficient detail for actual design purposes. Shorter wavelengths are desirable for small and medium energy accelerators because of the greater shunt impedance, smaller physical size and better economy. Wavelengths as short as 3 or 2 cm are considered possible with present techniques. Longer wavelengths are preferable for high-energy accelerators because the amount of available power per feed increases with wavelength like λ^u , $1 \leq u \leq 2$. (auth)

1080 NRL-4608

Naval Research Lab., Washington, D. C.
THEORY OF THE OPTICALLY FOCUSED SYNCHROTRON. [Interim Report]. D. C. dePackh. Aug. 3, 1955. 34p. Project NR 662-080.

Those features of the theory of synchrotron operation particularly appropriate to the accelerator being constructed at the Naval Research Laboratory are presented. A discussion of the alternating gradient accelerator is included together with the analysis of the NRL solenoid focused machine to permit an appreciation of the distinction between the two forms of optically focused machines, as well as the *raison d'être* for each. Particular attention is given to the specific effects of stray fields and focal errors, as well as of nonlinearity in the focal forces, as they occur in the optically focused accelerator. These, although important in all accelerators of this type, are especially so in the NRL machine, in which the resonant regions of the motion cannot be avoided but must be crossed. (auth)

1081 UCRL-3033

California. Univ., Berkeley. Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. V. [For period] February, March, and April 1955. Edward J. Lofgren and Harry G. Heard. Aug. 24, 1955. 22p. Contract W-7405-eng-48.

Four targets, three air locks, a deep well, and several thin windows for beam extraction in the target area were

completed. Simultaneous operation of up to five experiments has been achieved with a relay-controlled automatic operations selector. A beam-amplitude regulating device has been used to set the beam level on any pulse to within a few percent. The range of this equipment is 1000:1. Experimentation on the accelerator included measurements of start frequency and frequency-tracking jitter, beam-vs.-radial-aperture measurements, empirical study of gas scattering effects, and preliminary testing of an automatic beam-controlled frequency-tracking system. High-energy physics experiments have been performed by ten groups within this laboratory. These groups are using counter techniques for the elastic p-p scattering, K-particle half-life determination, and π^- -meson cross section measurements. A high-pressure H_2 diffusion chamber is being used to study multiple production of π^- mesons. A strong-focusing pair spectrometer has been used to produce beams of K particles. Emulsion exposures have been made to determine the masses and mean life times of K mesons. The interactions and modes of decay of K^\pm mesons at rest, as well as in flight, have been studied in emulsions. (auth)

1082 UCRL-3153

California. Univ., Berkeley. Radiation Lab.
A THREE-PHASE RADIOFREQUENCY SYSTEM FOR CLOVERLEAF CYCLOTRONS. Bob H. Smith. Oct. 5, 1955. 16p. Contract W-7405-eng-48.

Three cloverleaf cyclotrons employing three dees excited by three-phase rf were built. The phase generator that was used to produce the three-phase rf, the servo-mechanisms, and phase control equipment that were used to maintain the dees in tune, and the relationship of the electrical characteristics of the resonator to the control problem, are discussed. The rf systems were built in 3-kw and 37-kw sizes and could be extended to produce many megawatts of power, if necessary, by employing larger vacuum tubes. Cloverleaf cyclotrons appear to be capable of producing megawatts of beam power with an rf efficiency greater than 70%. (auth)

1083

THE EXTRACTION OF THE BEAM FROM THE LIVERPOOL SYNCHROCYCLOTRON. I. THEORETICAL. E. J. Le Couteur (Univ. of Liverpool, England). *Proc. Roy. Soc. (London)* A232, 236-41(1955) Oct. 25.

The beam has been efficiently extracted from the Liverpool synchrocyclotron by a magnetic deflector designed to produce radially unstable orbits while maintaining vertical stability. The theoretical specification of the apparatus is described. (auth)

1084

THE EXTRACTION OF THE BEAM FROM THE LIVERPOOL SYNCHROCYCLOTRON. II. EXPERIMENTAL WORK. A. V. Crewe and J. W. G. Gregory (Univ. of Liverpool, England). *Proc. Roy. Soc. (London)* A232, 242-51(1955) Oct. 25.

The paper gives the practical application of the principles of the preceding paper to the Liverpool synchrocyclotron and the designs of the various components of the extraction system are described, as well as the procedure for optimizing the extracted proton-beam current. In the final result, 3% of the circulating beam was extracted from the cyclotron tank. The beam has an energy of 383 Mev with no measurable energy-spread. By the aid of an auxiliary focusing magnet, the beam has been focused into a fairly well defined spot, and the proton-flux per sq.in. is at least

1000 times greater than that obtained from any similar machine. (auth)

Refer also to abstracts 922-1117.

RADIATION ABSORPTION AND SCATTERING

1085 AECD-3653

Los Alamos Scientific Lab., N. Mex.

A COMPARISON OF DIFFUSION THEORY AND TRANSPORT THEORY RESULTS FOR THE PENETRATION OF RADIATION INTO PLANE SEMI-INFINITE SLABS. W. D. Barfield, Richard von Holdt, and Fredrik Zachariasen. June 1954. Decl. with deletions Apr. 1, 1955. 39p. Contract W-7405-eng-36.

The penetration of radiation into plane semi-infinite slabs of material has been calculated numerically by means of the time-dependent transport theory (Boltzmann equation) and the approximate "diffusion theory." Quantitative results are given for the case of a nonscattering material with constant absorption cross section, and for the general case of a scattering material (boron) with absorption coefficient a function of energy. Results show that the diffusion theory calculation gives an energy penetration which is too large, but that in a time during which the diffusion wave penetrates to a depth corresponding to a few mean free paths, the rate of energy penetration calculated using the diffusion approximation approaches the value calculated using the exact theory. (auth)

1086 AERE-T/R-1617(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NEUTRON ATTENUATION IN CONCRETE. K. T. Spinney. Feb. 1955. 12p. (SWP/P.21(Del.))

The observed behavior of the penetrating neutrons in a concrete shield is accounted for by a simple theory making use of a calculated "transport" cross section for fast neutrons. This method is then linked with conventional age theory in an empirical manner so that a good fit is obtained to the observed neutron attenuation at all distances in the shield. (auth)

1087 IDO-16246

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIATION DOOR FOR HG-4 FACILITY NUCLEAR CALCULATIONS. G. H. Hanson. Dec. 16, 1953. 19p. Contract AT(10-1)-205. (MTR-L-247)

Planned use of the HG-4 hole in the MTR requires the design of a radiation-door assembly. Neutron and gamma shielding calculations have been made relative to the design of this unit. Calculations indicate the proposed design will be satisfactory for operating levels up to twice full-power. However, detailed shielding tests will be made to establish the adequacy of the proposed design. (D.E.B.)

1088 NRL-4640

Naval Research Lab., Washington, D. C.

DIFFERENTIAL ELASTIC SCATTERING OF 14-MEV NEUTRONS IN BISMUTH, TANTALUM, INDIUM, IRON, AND SULFUR. J. O. Elliot. Oct. 28, 1955. 98p. RDB Project NR 661-100.

The differential elastic scattering cross sections of Bi, Ta, In, Fe, and S for 14-Mev neutrons were measured at scattering angles between 5 and 55° with an angular resolu-

tion varying from ± 1 to $\pm 3^\circ$ using a cylindrical geometry and a biased scintillation detector with a threshold of 12 Mev. Multiple scattering corrections were made using an approximate theoretical method. The experimental results were compared to calculated cross sections using a phase-shift analysis based on the complex square-well model of the nuclear interaction. (auth)

1089 RM-1551(RAND)

RAND Corp., Santa Monica, Calif.

APPROXIMATE VALUES FOR THE CONTINUOUS ABSORPTION COEFFICIENTS OF AIR BETWEEN 2 AND 600 VOLTS. F. R. Gilmore and A. L. Latter. Aug. 24, 1955. 9p.

The absorption coefficient of air due to free-free and bound-free transitions has been calculated over the temperature and density ranges of 2×10^4 to 7×10^6 °K and 10^{-4} to 10 times normal density. The equations of Harris Mayer (LA-647) were used to calculate the average electronic occupation and ionization energy of the K, L, and M shells, the continuous absorption coefficient, and the Rosseland mean free path. Values of the ionization energy E_K , E_L , E_M were found to vary with temperature and density. Tables of numerical results are presented. (D.E.B.)

1090 UCRL-2808

California. Univ., Berkeley. Radiation Lab.

MEASUREMENT ON PROTON-PROTON SCATTERING IN THE ENERGY REGION 150 TO 340 MEV (thesis). Gordon H. Pettengill. Dec. 6, 1954. 71p. Contract W-7405-eng-48.

The 300-Mev proton-proton differential scattering cross section and polarization have been measured for center-of-mass scattering angles between 6.5° and 21.7°. Measurements of the integrated differential proton-proton cross section for angles between 20° and 90° center-of-mass have also been carried out by measurement of attenuation in liquid hydrogen at mean energies of 160, 230, and 330 Mev. In both sets of experiments, the incident beam was counted directly. An indication of destructive interference was noted in the small-angle region where Rutherford and purely nuclear effects are comparable. The attenuation measurements give a value of cross section in agreement with previous work at this laboratory. The hypothesis of charge-independent nuclear forces seems not to be violated. (auth)

1091

TOTAL CROSS SECTION OF p-p INTERACTION IN THE ENERGY INTERVALS OF 410 TO 660 MEV. V. P. Dzhelepov, V. I. Moskalev, and S. V. Medved. (Inst. of Nuclear Problems.). Doklady Akad. Nauk S.S.S.R. 104, 380-3(1955) Sept. 21. (In Russian) Cf NSA-10-333.

Investigations of energy relation of total cross section of p-p interaction in the energy interval of 400 to 600 Mev was made with the Inst. of Nuclear Problems synchrocyclotron. Results suggested that protons with 660 Mev energy become relatively "opaque" because the total cross-section of p-p interaction at such energies differ only slightly from the cross section in 850 to 1200 Mev. The most intensive forces between two protons act at the distance of 0.5×10^{-13} cm, while on larger distances they contribute little to the general interaction between two protons. (R.V.J.)

1092

RELATIVE STOPPING POWER OF VARIOUS METALS FOR

20-MEV PROTONS. C. P. Sonett and K. R. MacKenzie (Univ. of California, Los Angeles). *Phys. Rev.* 100, 734-7 (1955) Oct. 15.

The stopping powers of Ni, Cu, Cb, Pd, Ag, Cd, In, Ta, Pt, Au, and Th, relative to Al were measured using the 20.6-Mev external proton beam of the University of California at Los Angeles cyclotron. The measurements were made with sufficient precision so that a graph of $\ln Z$ vs stopping power/electron relative to Al showed some fluctuations from a linear relationship. For Th, the value differs by 2.6% in the direction found by Kelly and by Teasdale. The results are compared with the data compiled by Lindhard and Scharff. (auth)

1093

ENERGY LOSS OF PROTONS PASSING THROUGH HYDROGEN. A. Dalgarno (Queen's Univ. of Belfast) and G. W. Griffing (U. S. Air Force Center, Cambridge, Mass.). *Proc. Roy. Soc. (London)* A232, 423-34 (1955) Nov. 8.

The cross sections of processes involving protons and hydrogen atoms calculated by Bates, Dalgarno and Griffing using the Born approximation are employed to make a detailed analysis of the contributions of excitation, ionization, and capture to the stopping power of a gas of atomic hydrogen for a beam consisting initially of protons. A range of beam energies from 10 kev to 3 Mev is covered. The computed total energy loss is compared with experimental data and the accuracy of the Born approximation for heavy particle collisions is discussed. (auth)

1094

ANGULAR CORRELATION OF SCATTERED ANNIHILATION RADIATION. G. Bertolini, M. Bettoni, and E. Lazzarini (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). *Nuovo cimento* (10) 2, 661-2 (1955) Sept.

In order to test the theory that the polarization planes of the two quanta from positron-electron annihilation are perpendicular, the annihilation quanta were allowed to strike two scatterers, and the resulting Compton scattered quanta were recorded in coincidence. A Na^{22} source was used to obtain annihilation radiation and Al scatterers were placed in front of NaI(Tl) scintillators. Experimental arrangements and resulting spectra are shown. The ratio between the coincidence counts when the two detectors are at right angles to each other and the coincidence counts when the detectors are co-planar was found to be 2.32. (B.J.H.)

1095

SOME MONTE CARLO CALCULATIONS OF GAMMA-RAY PENETRATIONS. J. F. Perkins (Lockheed Aircraft Corp., Marietta, Ga.). *J. Appl. Phys.* 26, 1372-7 (1955) Nov.

The transmission of γ rays through slabs of various shielding materials has been calculated by a random sampling method in which the path lengths between interactions are deliberately chosen larger than those which occur naturally. Results for the case of normal incidence compare reasonably with values obtained by Goldstein and Wilkins for transmission in infinite media. The present results for the case of obliquely incident photons show the same general behavior as noted experimentally by Kirn, et al. In particular, the transmission plotted against slant path length shows a crossover, in the region of 1 or 2 mean free paths, of the curves corresponding to different incident angles. Angular and spectral distributions were obtained in the form of histograms, and it was found that the photons assume spatial equilibrium after one or two mean free paths, as

evidenced by the constancy of the flux-to-current ratio. The relative contribution to the total penetration arising from the first, second, etc. scattering has been found to have the same general trend as noted earlier by Peebles. The biased sampling method which was used enables one to use the same set of photon case histories in treating a number of slab thicknesses. (auth)

1096

SCATTERING OF X RAYS BY METHANOL - WATER MIXTURES. I. V. Radchenko and F. K. Shestakovskii. (Dnepropetrovskii Metallurgical Inst.). *Zhur. Fiz. Khim.* 29, 1456-8 (1955) Aug. (In Russian)

Water - methanol mixtures with methanol weight concentration of 20, 30, and 50%, and pure water and absolute methanol were studied. All experiments were made at 13°C temp. Results based on comparison of curves obtained from the angular distribution of x-ray-scattering intensity caused by water mixtures with methanol have proved that presence of methanol molecules strengthen the water structure by inducing stronger molecular associations. (R.V.J.)

Refer also to abstracts 977, 982, 1014, and 1136.

RADIATION EFFECTS

1097 USNRDL-453

Naval Radiological Defense Lab., San Francisco. HIGH INTENSITY CARBON ARC SOURCES FOR THERMAL RADIATION STUDIES. C. P. Butler. July 14, 1955. 39p. Project NS-081-001. (AFSWP-798)

A description of the 36-in. Navy Searchlight Source of thermal radiation shows that this source will provide an irradiance at the exposure plane of 90 cal/cm²/sec which can be delivered in either of two types of pulses, a triangular sweep pulse, or a square wave pulse. The photoelectric method of carbon position control, the method of monitoring the beam during an exposure and the spectral distribution of the radiant energy are shown. The Mitchell Source and its modifications for the study of the effects of thermal radiation on materials is described. The methods of making neutral attenuators of ground glass plates and the production of a variable type pulse mechanism are also given. The pertinent facts relating to various parameters of the two sources discussed in this report are presented in a table. (auth)

1098

DETERIORATION OF LUMINESCENT PHOSPHORS UNDER POSITIVE ION BOMBARDMENT. J. R. Young (General Electric Research Lab., Schenectady, N. Y.). *J. Appl. Phys.* 26, 1302-6 (1955) Nov.

The reduction of cathodoluminescence efficiency of phosphors has been observed after bombarding with H^+ , H_2^+ , He^+ , Ne^+ , N_2^+ , and A^+ ions having energies from 1 to 25 kev. Detectable deterioration could be observed after a bombardment of less than 10^{-3} coul/mm² of ions (5×10^{11} ions/cm²). The deterioration could be annealed out at temperatures between 450 and 700°C. Results indicate that light 25-kev ions probably penetrate 0.1 μ to 0.2 μ into the phosphor. (auth)

Refer also to abstract 776.

RADIOACTIVITY

1099 AD-37749

North Carolina State Coll., Raleigh.

THE RADIOACTIVITY OF SAMARIUM (thesis). Gene Edward Leslie. 1954. 26p.

Research was conducted to determine the half life of Sm and to measure the mean range of its α tracks in nuclear emulsion plates. Sm is the only naturally occurring element below Bi²⁰⁹ which exhibits α decay, with the possible exception of Nd. The half life of Sm is $(0.77 \pm 0.02) \times 10^{12}$ yr. For the active isotope, Sm¹⁴⁷, the half life is $(1.15 \pm 0.03) \times 10^{11}$ yr. The mean range of the Sm α particles is $7.2 \pm 0.4 \mu$ in the Ilford C-2 emulsion. On the basis of range-energy relations, an energy of 2.18 ± 0.14 Mev was assigned. (ASTIA abst.)

1100 IDO-16057

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ALUMINUM RABBIT SHIELDING REQUIREMENTS. M. W. Holm. Jan. 2, 1953. Decl. Sept. 22, 1955. 12p. Contract [AT(10-1)-205].

A 120-gm. 61-ST Al rabbit irradiated for 100 min. in the MTR hydraulic rabbit facilities and allowed to cool for two minutes cannot be manipulated without shielding (at 80 feet in air the allowable daily dose of 0.06 r is received in one min.). With an irradiation time of two weeks, however, a cooling period of 100 min allows an operator to work on the rabbit for one min at 18 in. in air before receiving 0.06 r, and this distance can be reduced to 11 in. by allowing the rabbit to cool 12 hrs. With two-min cooling, 7.5 in. of Pb, or 14 in. of Pb glass gives adequate protection for a working period of one min per day. (auth)

1101 NARF-55-68T

Consolidated Rultee Aircraft Corp., Fort Worth, Tex. DEGRADED RADIATION FROM A LARGE Co⁶⁰ SOURCE. C. F. Cook, T. P. Lang, and D. M. Wheeler. Oct. 28, 1955. 24p. Contract AF33(038)-21117. (MR-N-101)

A two-crystal Compton spectrometer was used to measure the degraded γ radiation from a large Co⁶⁰ source. The degraded radiation was attributed to internal-source scattering and scattering due to the air column between source and detector. The total intensity of the degraded radiation in the range of from 0.3 Mev to 1 Mev was no more than 22% of the combined intensity of 1.17- and 1.33-Mev γ rays. The source intensity was measured August 18, 1955, and found to be 19.9 curies. (auth)

1102 AEC-tr-2311

STUDY OF Th¹⁴⁰ EMISSION. L. Ya. Shavtalov. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 17, 503-6 (1953). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-3591.

1103 AEC-tr-2312

BETA SPECTRUM OF Re¹⁸⁶. N. M. Anton'eva, A. A. Bashilov, B. S. Dzhelepov, and L. S. Chervinskaya. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 17, 507-10(1953). 7p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-3509.

1104

YALE NATURAL RADIOCARBON MEASUREMENTS. II.

Richard S. Preston, Elaine Person, E. S. Deevey. Science 122, 954-60(1955) Nov. 18.

Data on the age of archeological specimens determined by measurement of natural radiocarbon are presented. A brief description of each specimen is included. Specimens are classified as Alaskan Little Ice Age and related samples, North American geological specimens, and Caribbean archeological specimens. Most of the data reported were obtained using the acetylene method of Suess, which is briefly outlined. (C.H.)

1105

LOW-ENERGY SCATTERED RADIATION INSIDE A CYLINDRICAL Co⁶⁰ SOURCE. William Bernstein and Robert H. Schuler (Brookhaven National Lab., Upton, N. Y.). Nucleonics 13, No. 11, 110-12(1955) Nov.

The low energy scattered radiation inside a cylindrical Co⁶⁰ source was studied by scintillation spectrometry, and a typical spectrum is shown. The importance of the scattered radiation is illustrated by a comparison of the decomposition rate of methyl iodide to that of ferrous sulfate oxidation, the measurements being made in cylindrical sources. (B.J.H.)

1106

PREPARING "BUILT-UP" FILMS OF COBALT-60 STERATE. Daniel T. Haworth, John R. Koch, Robert J. Martinovich, and John G. Surak (Marquette Univ., Milwaukee). Nucleonics 13, No. 11, 112-14(1955) Nov.

Monomolecular films of Co⁶⁰ stearate were formed by spreading a radioactive metallic soap of Co⁶⁰ ions in aqueous solution with stearic acid on a bath surface. By withdrawing a slide through the bath surface, a monolayer of the metallic soap forms on the slide. The relationship of Co⁶⁰ activity and the number of monolayers and the percent conversion to metallic soap were determined. (B.J.H.)

1107

THE DECAY SCHEME OF ¹⁴⁰La. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 46, 1132-4(1955) Oct.

Investigation of the La¹⁴⁰ decay revealed γ rays of energies 328, 486, 815, 893 \pm 40, 1597, and 2570 \pm 150 kev with relative intensities of 25 \pm 10, 48 \pm 8, 27 \pm 5, 11 \pm 4, 100 and 4 \pm 1. (D.E.B.)

1108

RADIOACTIVE TANTALUM¹⁸⁶. A. J. Poe (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 46, 1165-8(1955) Nov.

The new radioactive isotope Ta¹⁸⁶ has been prepared, and its decay characteristics determined: half life: 10.5 \pm 0.5 min., maximum β energy: 2.2 Mev., conversion-electron energies: \approx 0.15 Mev, and γ -ray energies: 125,200, 300, 410, 510, 610, 730, 940 and possibly \sim 1150 kev. The mass assignment suggested by its production by (n, p), but not by (γ , p), reactions on W was confirmed by experiments using tungstic acid enriched in W¹⁸⁶. (auth)

1109

ELECTRIC QUADRUPOLE LIFETIMES IN EVEN-EVEN NUCLEI. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 46, 1135-6(1955) Oct.

Two groups of coincidence measurements have been carried out in an attempt to determine the lifetime of a

number of γ ray transitions. In the first group, mean lifetimes were obtained from the side slopes of coincidence curves; in the second, lifetimes were deduced from the centroid shift between pairs of β - γ coincidence curves. Results for 10 isotopes are tabulated. (D.E.B.)

1110

A PRECISION RE-MEASUREMENT OF THE Ni^{60} GAMMA-GAMMA DIRECTIONAL CORRELATION FUNCTION. S. Colombo (Istituto Nazionale di Fisica Nucleare, Milan, Italy) and A. Rossi and A. Scotti (Univ. of Milan, Italy). *Nuovo cimento* (10) 2, 471-86(1955) Sept.

A precision re-measurement of the directional correlation function of the Ni^{60} γ - γ cascade, obtained through beta decay of metallic Co^{60} , has been performed. The experimental apparatus includes, as scintillation counters, Du Mont Type 6292 photomultipliers, coupled with $1'' \cdot 1''$ cylindrical anthracene crystals, and a coincidence circuit with a resolving time of $4 \cdot 10^{-8}$ s. The experimental results are reported, with a discussion of the systematic errors involved and of the experimental corrections introduced. The comparison with the theoretical results, assuming the usual unperturbed $4(E2)2(E2)0$ cascade, shows a very close agreement. (auth)

1111

ON A NEW SERIES OF ANTIMONY - TIN ISOBARS. I. G. de Fraenz, J. Rodriguez, and H. Carminatti. *Publ. com. nacl. energia atomica* (Buenos Aires), Ser. quim. 1, No. 2, 11-18(1955). (In Spanish)

A new tin isotope was found as a fission product of U irradiated with deuterons. Its half life of 57 ± 2 minutes was determined by separations of its daughter substance. The half life of the daughter, an antimony isotope, was measured as 10.3 ± 0.3 minutes and its maximum β energy about 2.9 Mev. (auth)

1112

THE BETA-DECAY OF Pa^{233} . Ong Ping Hok and P. Kramer (Natuurkundig Laboratorium der Vrije Universiteit, Amsterdam, Netherlands). *Physica* 21, 676-84(1955) Aug. (In English)

Further measurements on the electron spectrum of Pa^{233} have been performed. 14 γ transitions were determined from the observed conversion lines. A very weak indication was found of an electron line at 360 kev which might be the K-conversion line of a 475.6 kev transition. The Fermi-Kurie analysis led to three partial β -spectra with endpoints of 568 ± 5 , 257 ± 5 and 145 ± 10 kev and intensities of 5, 58, and 37%, respectively. These results agree with the decay scheme proposed by Brodie. γ - e^- and β - e^- coincidences were also performed. (auth)

1113

GAMMA RADIATION IN THE DECAY OF ^{67}Ga . L. H. Th. Rietjens and H. J. Van Den Bold (Fysisch Laboratorium der Rijksuniversiteit, Utrecht, Netherlands). *Physica* 21, 701-18(1955) Sept. (In English)

The level scheme of ^{67}Zn has been investigated by scintillation coincidence spectrometry. Angular correlation measurements of the 206 to 182 kev and 485 to 296 kev gamma cascades result in anisotropies of -0.216 ± 0.008 and $+0.27 \pm 0.05$. The following spins have been allocated to the levels of ^{67}Zn : ground state $5/2$, 92 kev $3/2$, 182 kev $5/2$, 388 kev $3/2$ and 870 kev $3/2$. Evidence has been found for the existence of another level at 595 ± 10 kev, for which a spin of $5/2$ is suggested. By delayed coincidences a value of

9.3 ± 0.2 μsec has been found for the half life of the 92-kev metastable level in ^{67}Zn . (auth)

1114

THE BETA-DECAY OF ^{230}Pa . Ong Ping Hok, P. Kramer, G. Meijer, J. W. R. Fennema, and W. L. Zijp (Univ. of Amsterdam, Netherlands). *Physica* 21, 719-27(1955) Sept. (In English)

The beta decay of ^{230}Pa was investigated with a magnetic beta and a scintillation spectrometer. This led to 9 gamma transitions from which two possible schemes of ^{230}Th could be constructed. A positron spectrum and a negatron spectrum with maximum energies of 0.4 Mev and 0.405 ± 0.02 Mev were also observed. These results, however, are not so certain because of possible contaminations of fission products. (auth)

1115

RADIATIONS OF COPPER 59. L. Lindner, G. A. Brinkman, and A. C. Pieterse (Instituut voor Kernfysisch Onderzoek, Amsterdam, Netherlands). *Physica* 21, 745-6(1955) Sept. (In English)

An observed positron period of $82 \pm \text{sec}$ after deuteron irradiation of Ni foils was assigned to Cu^{59} . A maximum energy of 3.4 ± 0.5 Mev for the positrons was obtained, and γ rays of 0.88 ± 0.02 and 1.31 ± 0.02 Mev were also detected. Indications were found for at least two other γ rays between 1.5 and 3.0 Mev. (L.M.T.)

Refer also to abstracts 934, 1018, and 1118.

SHIELDING

Refer also to abstracts 1035 and 1087.

SPECTROSCOPY

1116 NP-5803

Cornell Univ., Ithaca, N. Y.

THE EXTREME ULTRAVIOLET SPECTRA OF SOLIDS. Final Report [for] July 1, 1952-September 15, 1955.

D. H. Tomboulion. Oct. 15, 1955. 24p. Project 599-01-004. Contract DA-30-115-ORD-325.

Absorption measurements were made in the wavelength region extending from 60 Å to 450 Å on Be, BeO, Si, SiO, SiO₂, P, S, Cr, Mn, Ni, and Ge. Data are presented graphically. Problems associated with absorption measurements are discussed. Results are reported from extended research on the average synchrotron power spectrum emitted over a partial or full acceleration interval during which the electron energy reached the values of 233 and 321 Mev, respectively, and measurements which deal with the angular distribution of the radiation relative to the orbital plane. Experimental results are presented graphically at various wavelength positions. (C.H.)

1117

NP-5805

Cornell Univ., Ithaca, N. Y.

ON THE SPECTRAL AND ANGULAR DISTRIBUTION OF ULTRAVIOLET RADIATION FROM THE 300 MEV CORNELL SYNCHROTRON. D. H. Tomboulion. Nov. 15, 1955. 16p. DA Project No. 5B99-01-004. Contract DA-30-115-ORD-669.

The spectral characteristics of the radiation emitted by high energy centripetally accelerated electrons have been

examined in the ultraviolet region extending from 60 to 400 Å. A grazing incidence vacuum spectrograph was used to record the average power spectrum emitted over a partial or full synchrotron acceleration interval. The radiation was detected photographically, and photometric procedures were followed in reducing the spectrograms. The spectrograms were compared with predictions from classical radiation theory of accelerated electrons, and reasonably good agreement was observed. It is suggested that the observed continuous radiation might be a suitable source for absorption measurements in the far ultraviolet. (M.P.G.)

1118 ORNL-1317

Oak Ridge National Lab., Tenn.

THE X-RAY SPECTRA OF POLONIUM ATOMIC NUMBER 84. W. F. Peed, L. E. Burkhart, R. A. Stanforth, and L. G. Fauble. Apr. 15, 1952. Decl. Oct. 5, 1954. 17p. Contract W-7405-eng-26.

Two samples, each containing an estimated 10 curies (2 mg) of polonium-210, were purified by vacuum distillation and evaporated onto oblique sections of x-ray targets made of copper. Four lines of the K series and ten lines of the L series of the x-ray spectrum of polonium were recorded with a one-meter transmission crystal spectrograph and a 25-centimeter Bragg spectrograph, respectively. Measured wavelengths agree approximately with values predicted by extrapolation of Moseley's law and with those claimed by Hulubel. Decay of polonium-210 (half life = 138 days) and growth of lead-206 (stable) were observed over a period of 180 days. (auth)

1119 AEC-tr-2297

A SIMPLE METHOD FOR COMPUTATION OF APPROXIMATE VALUES OF VIBRATIONAL FREQUENCIES IN ISOTOPIC MOLECULES. Josef Plíva and Bohdan Schneider. Translated from *Chem. Listy* 49, 149-57(1955). 24p.

The determinant equation, $|G^* G^{-1} \Lambda - \rho \lambda^* I| = 0$, (where G is the array of non-dimensional kinematic constants, $\rho \lambda$ the vibrational frequency, I the unit array, and Λ the diagonal array) has been used as a basis for the computation of approximate values of all vibrational frequencies of isotopically substituted molecules from the frequencies of a basic molecule. The values obtained fulfill the laws of sum and products. (C.W.H.)

1120 AEC-tr-2301

APPLICATION OF MOLECULAR BEAMS FOR THE RADIO SPECTROSCOPIC STUDY OF ROTATIONAL SPECTRA OF MOLECULES. N. G. Basov and A. M. Prokhorov. Translated by Arie [Lew] Eichenbaum from *Zhur Eksptl'. i Teoret. Fiz.* 27, 431-8(1954). 16p.

The use of molecular beams makes it possible to obtain narrow spectral lines ~7 kc in width and to study rotational spectra of substances normally in a solid state. Expressions for the spectral line width and for the sensitivity of the spectroscopy are derived. The use of cavity resonators to reduce Doppler broadening and the use of inhomogeneous electric fields to sort molecules according to their rotational states are discussed as methods of increasing sensitivity. (M.P.G.)

1121 AEC-tr-2309

ISOTOPIC EFFECT IN ATOMIC SPECTRA. A. R. Striganov and Iu. P. Dontsov. Translated from *Uspekhi Fiz. Nauk* 55, 315-90(1955). 119p.

1122

EXPERIMENTS WITH CHROMATIC PHOTOGRAPHY FOR DEIPHERING SPECTRA OF DIFFRACTION GRATING SPECTROGRAPHS. Yu. I. Belyaev and G. V. Mikhailova (Vernadskii Inst. of Geochemistry and Analytical Chemistry). *Doklady Akad. Nauk S.S.S.R.* 104, 38-9(1955) Sept. 1. (In Russian)

Chromatic spectra photographs of iron taken on a Bairds Associates three-meter diffraction spectrograph with 15,000 lines per inch and 5.2 Å/mm dispersion are discussed. Photographic diagrams are given. (R.V.J.)

1123

THE X-RAY SPECTRA OF μ -MESONIC COPPER AND LEAD. F. D. S. Butement (Atomic Energy Research Establishment, Harwell, Berks, England). *Phil. Mag.* (7) 46, 1136-9(1955) Oct.

Cu and Pb were bombarded with μ mesons from the Liverpool cyclotron. The mesonic x rays emitted were detected with a NaI (Tl) crystal. Energy spectra show a 1.55-Mev peak for Cu and 4.82-, 5.33- and 5.84- Mev peaks for Pb. (D.E.B.)

1124

FAR ULTRAVIOLET ABSORPTION SPECTRA OF ETHYLENE AND ETHYLENE- d_4 . P. G. Wilkinson and R. S. Mulliken (Univ. of Chicago). *J. Chem. Phys.* 23, 1895-1907(1955) Oct.

The absorption spectra of ethylene and ethylene- d_4 have been reinvestigated in the 1500 to 2050 Å region, using the first order of the Harrison 21 foot vacuum spectrograph. Vibrational constants of the C=C stretching vibration in the R (first Rydberg) state were determined to be: C_2H_4 , $\omega_2^0 = 1381.5 \text{ cm}^{-1}$; $x_{22}^0 = -11.2 \text{ cm}^{-1}$; C_2D_4 , $\omega_2^0 = 1306.8 \text{ cm}^{-1}$; $x_{22}^0 = -8.2 \text{ cm}^{-1}$; and (tentatively) in the V state: C_2H_4 , $\omega_2^0 = 852 \text{ cm}^{-1}$; $x_{22}^0 = -1.9 \text{ cm}^{-1}$; C_2D_4 , $\omega_2^0 = 797 \text{ cm}^{-1}$; $x_{22}^0 = -1.8 \text{ cm}^{-1}$. Newly observed fine structure in the $v'-0$ stretching vibration progression in the long wavelength part of the $V \leftarrow N$ transition of C_2D_4 is tentatively attributed to a torsional oscillation. The $0-0$ bands of the $V \leftarrow N$ transition, though too weak to be seen, were estimated to lie near 2500 Å. The probable dissociation of ethylene into CH_2 radicals in the $V \leftarrow N$ continuum is discussed. (auth)

1125

CHEMICAL SHIFTS OF NITROGEN. B. E. Holder and M. P. Klein (Univ. of California, Livermore). *J. Chem. Phys.* 23, 1956(1955) Oct.

The chemical shifts of the nuclear magnetic resonance of O^{17} in various nitrogenous compounds, relative to water, have been measured and an explanation is presented in terms of the electronic wave functions. (C.W.H.)

1126

OBSERVATION OF CHEMICAL SHIFTS OF O^{17} NUCLEI IN VARIOUS CHEMICAL ENVIRONMENTS. H. E. Weaver (Varian Associates, Palo Alto, Calif.) and B. M. Tolbert and R. C. La Force (Univ. of California, Berkeley). *J. Chem. Phys.* 23, 1956-7(1955) Oct.

The chemical shifts of the nuclear magnetic resonance of nitrogen in various compounds, relative to the NO_2^- ion, have been measured. (C.W.H.)

1127

MICROWAVE SPECTRUM OF IMINE-DEUTERATED ETHYLENIMINE. T. E. Turner, Verna C. Fiora, and W. M. Kendrick (Ballistic Research Labs., Aberdeen Proving Ground, Md.). *J. Chem. Phys.* 23, 1966(1955) Oct.

The rotational spectrum of C_2H_4ND has been analyzed. Rotational constants and structural parameters were calculated. (C.W.H.)

1128

SPECTROGRAPHIC DETERMINATION OF NITROGEN ISOTOPIC CONTENT. A. I. Gorbunov and P. A. Zagorets. (Mendeleev Chemicotechnological Inst.) *Zhur. Fiz. Khim.* 29, 1442-6(1955) Aug. (In Russian)

Native standard quartz spectrometers and microphotometers were used in nitrogen isotopes analysis. Evaluation of the intensity lines relations for $N^{14}N^{14}$ and $N^{14}N^{15}$ molecules was based on blackened curve tracings constructed with a nine-stage clearing agent. Analysis proved the successful application of the native equipment and the method of using the stage-clearing agent in analysis of specimens of low concentration. (R.V.J.)

Refer also to abstract 994.

THEORETICAL PHYSICS

1129 AECU-3111

RAND Corp., Santa Monica, Calif.

THE GRÜNEISEN PARAMETER FOR AN EINSTEIN SOLID AND UNDER FINITE STRAIN. J. J. Gilvarry. Sept. 26, 1955. 28p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48]. Subcontract SC-64. (RM-1556-AEC).

The Grüneisen constant, as evaluated from the equation of state, is obtained for an Einstein solid. The presence of a state of finite hydrostatic pressure is taken into account explicitly by means of Murnaghan's theory of finite strain to obtain the Grüneisen parameters on the Debye and Einstein models. Results are identical in the two cases with the corresponding values obtained without use of the formal theory of finite strain. (auth)

1130 UCRL-2884

California. Univ., Berkeley. Radiation Lab.

THE OPERATOR FORMALISM IN QUANTUM PERTURBATION THEORY. Bryce S. DeWitt. Sept. 1955. 281p. Contract W-7405-eng-48.

A review is presented of formal perturbation theory as it has been developed in the past few years. Most of the important formulas found in the literature are presented. The emphasis is on showing that the formal theory provides an adequate skeleton on which to hang the whole of quantum perturbation theory and therefore plays a valuable unifying role. Topics to which attention is devoted include: Green's functions; scattering theory, level shifts, state vector normalization, bound state perturbation theory, renormalization theory of quantized fields, decay and resonance phenomena, and the theory of nuclear reactions. (auth)

1131 AEC-tr-2254

THE MOTION OF CHARGED PARTICLES IN A HOMOGENEOUS MAGNETIC FIELD ON WHICH IS APPLIED THE MAGNETIC FIELD OF A LINEAR CURRENT AND THE ELECTRIC FIELD OF A CYLINDRICAL CONDENSER. V. M. Kel'man and S. Ya. Yavor. Translated from *Zhur. Tekh. Fiz.* 24, 1329-32(1954). 4p. Available from Associated Technical Services (Trans. 55G6R), East Orange, N. J.

Expressions, in the form of quadratures, are obtained defining the motion of charged particles in a homogeneous

magnetic field to which is applied the magnetic field of a linear current and the electric field of a cylindrical condenser. Numerical integrations are carried out in several specific cases. (auth)

1132 TT-558

A NOTE ON THE ENERGY LEVELS OF HELIUM-LIKE ATOMS. (K Voprosu Ob Energeticheskikh Wrovnakh Geliepodobnykh Atomov). A. I. Andreev. Translated by G. Belkoe from *Vestnik Moskov. Univ. Ser. Fiz.-Mat.* 1 Estestven. Nauk, No. 5, 65-9(1954). 9p.

A term proportional to the δ function which was neglected in previous considerations of the above problem, is found to be not only necessary in finding the energies of the fundamental state of a helium-like atom, but should be used in all other similar cases. (L.M.T.)

1133

TAMM-DANCOFF METHOD. V. P. Silin and V. Ya. Fainberg. *Uspekhi Fiz. Nauk* 56, 569-635(1955) Aug. (In Russian)

A detailed review of Tamm-Dancoff old and new methods for quantum meson theory is given. 113 references. (R.V.J.)

1134

THE NUCLEON GREEN FUNCTION IN PSEUDOSCALAR MESON THEORY. I. S. F. Edwards (Univ. of Birmingham, England). *Proc. Roy. Soc. (London)* A232, 371-6(1955) Nov. 8.

The method of functional integration has been previously applied to the evaluation of Green functions, in particular to the one-nucleon Green function in the cases of neutral scalar and charged scalar mesons interacting with a static nucleon. This work is extended in this and subsequent papers to pseudoscalar meson theory allowing nucleon recoil. In this paper the formal extension, in particular the inclusion of vacuum polarization effects, is made and the resulting forms discussed. In particular, the comparison between forms arising from the usual interaction of fermions and bosons with the analogous boson-boson forms striking dissimilarity. The reduction of the evaluation of the functional integral is discussed in part II (see succeeding abstract). (auth)

1135

THE NUCLEON GREEN FUNCTION IN PSEUDOSCALAR MESON THEORY. II. S. F. Edwards (Univ. of Birmingham, England). *Proc. Roy. Soc. (London)* A232, 377-89(1955) Nov. 8.

Following the formal work of the preceding paper, a method is proposed to evaluate the functional integral which has been derived for the Green function of one nucleon interacting with a pseudoscalar meson field. The method is basically that of stationary phase taken to its second approximation, and since this approximation where applicable is accurate in the limits of strong and weak coupling constants, it is assumed good in general. There are several difficulties involved in the evaluation, and as far as possible these are isolated and discussed with the aid of models each showing one difficulty alone. Combining these separate points, the evaluation of the function integral is thereby expressed in terms of the solution of a set of coupled equations which provide a basis for a covariant intermediate coupling approach to the problem. The solution of these equations is not attempted in this paper. (auth)

1136

MULTIPLE ISOTROPIC SCATTERING. Paul I. Richards (Technical Operations, Inc., Arlington, Mass.). *Phys. Rev.* 100, 517-22(1955) Oct. 15.

A formalism is derived for approximately solving problems in the transport of radiation or particles by isotropic scattering with absorption. Although the present theory is very similar to diffusion theory, comparison with rigorous solutions where available shows that the results are more accurate than those of diffusion theory especially in highly absorbing media and in regions close to sources. Moreover certain ambiguities and difficulties in extending diffusion theory are eliminated. The derivation proceeds directly from rigorous transport equations and is based on a series expansion for integrals of the Helmholtz type. (auth)

1137

DEUTERON STABILITY IN MESON THEORY. E. L. Feinberg and D. S. Chernavskii. (Lebedev Physics Inst.) *Doklady Akad. Nauk S.S.S.R.* 103, 589-93(1955) Aug. 1. (In Russian)

1138

THEORY OF TURBULENCE AND ASYMPTOTIC BEHAVIOR OR GREEN'S FUNCTIONS IN ELECTRO-DYNAMICS OF PARTICLES WITH ZERO SPIN. L. P. Gor'kov and I. M. Khalatnikov (Vavilov Inst. of Problems in Physics.). *Doklady Akad. Nauk S.S.S.R.* 103, 799-802 (1955) Aug. 11. (In Russian)

1139

ASYMPTOTIC BEHAVIOR OF GREEN'S FUNCTION IN ELECTRO-DYNAMICS OF PARTICLES WITH ZERO SPIN. L. P. Gor'kov and I. M. Kholatnikov. (Vavilov Inst. of Physics Problems). *Doklady Akad. Nauk S.S.S.R.* 104, 197-200(1955) Sept. 11. (In Russian)

The author undertakes to prove that by special selection of the linear section of Green's photon function equal to its lateral section the problem is simplified and with such approximation renormalization of congruent operators and vertex sections can be considered. (R.V.J.)

1140

ON INTERACTION OF BOSON-FERMION FIELDS. V. V. Chavchanidze. (Georgia Inst. of Phys.). *Doklady Akad. Nauk S.S.S.R.* 104, 205-8(1955) Sept. 11. (In Russian)

Basic equations for nucleon-meson dynamics are developed. (R.V.J.)

1141

ON THE POSSIBLE EXISTENCE OF DEGENERATE CHARGED STATES OF HEAVY UNSTABLE BOSONS IN THE GELL-MANN-PAIS THEORY. N. Dallaporta and L. Taffara (Univ. of Padova, Italy). *Nuovo cimento* (10) 2, 418-24(1955) Sept.

The assumption by which degenerate charged states of heavy unstable bosons may exist in the framework of the Gell-Mann-Pais theory is studied. These states should be invariant with opposite parities under combined operations of charge conjugation and charge symmetry so that they can undergo different and mutually exclusive decay processes. It is found that such degenerate states may exist only if one assumes the third scheme of hyperonic levels of Gell-Mann-Pais, which postulates more Λ and Σ charged states than are up to now experimentally known, and, moreover, only if one postulates that reactions between nucleons, which

should give associated production of hyperons, are always forbidden. (auth)

1142

THE LOW ENERGY NUCLEAR MECHANICS AND THE INDEPENDENT PARTICLE MODEL. A. Kind (Univ. of Padova, Italy). *Nuovo cimento* (10) 2, 443-9(1955) Sept.

The independent particle model of the nucleus is analyzed in its definition as an approximation to weak incoherent interaction and its applicability to general problems of low energy nuclear mechanics. In zero approximation, defined by a condition of self consistency, the potential wells which determine the states of the single nucleons in the nucleus have a mean depth of the order of twice the mean potential energy per nucleon. It gives the result, for instance, that direct emission and evaporation processes of nucleons have different thresholds. It is emphasized that the optical model for nuclear reactions can be directly derived from the model considered. (auth)

Refer also to abstracts 945, 1008, 1019, 1023, 1055, and 1060.

TRACER APPLICATIONS

Refer also to abstract 869.

URANIUM AND URANIUM COMPOUNDS**1143 BMI-980**

Battelle Memorial Inst., Columbus, Ohio. EFFECT OF HYDROGEN ON THE TENSILE TRANSITION IN URANIUM. L. L. Marsh, G. T. Muchlenkamp, and G[eorge] K. Manning. Feb. 14, 1955. Decl. May. 5, 1955. 20p. Contract W-7405-eng-92.

A study has been made of the effect of hydrogen and heat treatment on the ductility transition in alpha uranium. A transition from ductile to a semibrittle behavior in tension has been observed in the temperature range 75 to approximately 150°F. The transition is sensitive to residual strain, strain rate, hydrogen content, and to a smaller extent to heat treatment. On the basis of the data available, the transition appears to be similar to transitions observed in other metals not of the face-centered-cubic type, and is not the result of hydrogen embrittlement. The effect of hydrogen in the composition range 0.3 to 4.7 ppm hydrogen seems to be observed principally in the values for reduction in area. At 4.7 ppm hydrogen, the amount of necking, i.e., the reduction of area, at fracture is noticeably less than for material that has been dehydrogenated. (auth)

1144 IDO-16195

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho. ESTIMATED MASS OF URANIUM-233 IN MTR THORIUM SLUGS. George H. Hanson. Sept. 20, 1954. Decl. Sept. 28, 1955. 6p. Contract AT(10-1)-205.

The mass of U^{233} plus Pa^{233} present in the Th "W" slugs varied between about $1\frac{1}{2}$ and 8 grams per slug; the irradiation periods varied between 71 and 302 operating days. The mass of U^{233} and Pa^{233} present in those Th slugs which were irradiated for one year and seven months varied between approximately $1\frac{1}{2}$ and 6 grams per slug.

Since the mass of Th per slug was 1660 grams, the highest concentration of the fissionable U^{233} produced in the MTR to data is about 0.5%. The concentration of fission products in the "hottest" slugs is approximately 0.1 wt.%. (auth)

1145 LA-1336

Los Alamos Scientific Lab., N. Mex.

THE FISSION CROSS SECTION OF U^{235} FROM 0.4 TO 1.6 MEV. Benjamin C. Diven, Harold V. Argo, Robert C. Allen, Samuel J. Bame, Jr., Robert W. Crews, Malcolm Ennis, Arthur Hemmendinger, Herbert C. Martin, Richard F. Taschek, James Terrell, and William E. Scott. Feb. 3, 1953. Decl. Sept. 19, 1955. 25p. Contract W-7405-eng-36.

The U^{235} fission cross section was measured with about 80 kev resolution by comparison with the n,p scattering cross section. The experiment consisted of counting proton recoils ejected from a hydrogeneous radiator in a neutron flux while simultaneously counting fissions occurring in a thin film of U^{235} placed near the radiator. (M.P.G.)

1146 NYO-5131

[Mallinckrodt Chemical Works, St. Louis].

FREEZING POINT OF AAA [PITCHBLENDE] ORE. O. J. Buckheim. July 19, 1945. Decl. Nov. 2, 1955. 2p.

Samples with varying moisture content were made from dried pitchblende ore for determining the freezing point at a given moisture content. Moisture contents of 12% and above were found to cause freezing at 0°C. With moisture contents below 12% the larger ore particles remained free and the smaller particles were impacted at 0°C. (D.E.B.)

1147

DEFORMATION MECHANISMS OF ALPHA-URANIUM SINGLE CRYSTALS. L. T. Lloyd and H. N. Chiswick (Argonne National Lab., Lemont, Ill.). J. Metals 7, 1206-14(1955) Nov.

The operative deformation elements in α -uranium single crystals under compression at room temperature have been determined as a function of the compression directions. The deformation mechanisms noted may be arranged with respect to their frequency of occurrence and ease of operation in the following order: 1—(010)–[100] slip, 2—{130} twinning, 3—{~172} twinning, and 4—under special conditions of stress application, kinking, cross-slip, {~176} twinning,

and {011} slip. The composition planes of the {172} and {176} systems were found to be irrational. Crossslip was shown to be associated with the major (010) slip system, coupled with localized interaction of slip on the (001) planes. The mechanism of kinking was found to be similar to that observed in other metals in that it occurred chiefly when the compression direction was nearly parallel to the principal slip direction [100] and was associated with a lattice rotation about an axis contained in the slip plane and normal to the slip direction; the [001] in the uranium lattice. The resolved critical shear stress for slip on the (010)–[100] system was found to be 0.34 kg per mm². In a single test it was shown that under compression in suitable directions twinning on the {130} also occurs at 600°C. (auth)

1148

MAGNETIC AND THERMAL PROPERTIES OF U_3 AT LIQUID HELIUM TEMPERATURES. L. D. Roberts and R. B. Murray (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 650-4(1955) Oct. 15.

Previous measurements of the magnetic susceptibility of U_3 revealed a susceptibility maximum near 3.2°K of antiferromagnetic character, and a second susceptibility maximum at 1.5°K which is strongly depressed by an applied magnetic field of only 5 to 10 oersteds. The specific heat of U_3 has now been measured by 1.2° to 4.2°K. These measurements show a λ -type anomaly of magnitude 10 joules/mole-deg at 2.61°K which is interpreted as arising from the antiferromagnetic transition. The behavior of the entropy and specific heat curves indicates an extensive short-range order above the antiferromagnetic transition point. The lower temperature susceptibility anomaly is tentatively interpreted as a manifestation of the growth of long-range antiferromagnetic order. (auth)

1149

AN EXAMPLE OF URANIUM NUCLEUS FISSION INTO FOUR FRAGMENTS OF COMPARABLE MASS. Yu. S. Ivanov (Lebedev Physics Inst.) Doklady Akad. Nauk S.S.S.R. 104, 40-3(1955) Sept. 1. (In Russian)

Uranium fission into four heavy fragments observed in uranium filled emulsion exposed to a synchrotron photon beam of 15 Mev is described. (R.V.J.)

Refer also to abstracts 542, 616, 719, 822, 878, 887, 992, and 1073.

